11.0 DEVELOPMENT OF EFFLUENT LIMITATIONS AND STANDARDS

This chapter presents the final effluent limitations guidelines and standards for the landfills point source category. EPA bases the final effluent limitations upon the performance of selected wastewater treatment systems at landfill facilities and develops limitations expressed as monthly-average and daily-maximum concentrations. The following sections discuss the development of the numerical, technology-based limitations:

- Development of Long-Term Averages, Variability Factors, and Effluent Limitations
- Best Practicable Control Technology Currently Available (BPT)
- Best Conventional Pollutant Control Technology (BCT)
- Best Available Technology Economically Achievable (BAT)
- New Source Performance Standards (NSPS)
- Pretreatment Standards for Existing Sources (PSES)
- Pretreatment Standards for New Sources (PSNS)

11.1 Development of Long-Term Averages, Variability Factors, and Effluent Limitations

The section below presents a summary of the statistical methodology used in the calculation of effluent limitations. (As explained in section 11.6, et.seq., EPA decided not to establish pretreatment standards for landfills). A more detailed explanation can be found in the "Statistical Support Document for the Final Effluent Limitations Guidelines and Standards for the Landfills Point Source Category" (EPA-821-B-99-007).

EPA bases effluent limitations for each subcategory on a combination of long-term average effluent concentrations and variability factors that account for variation in treatment performance within a treatment system over time. The Agency developed variability factors and long-term averages from a database composed of individual daily measurements of treated effluent at landfills. EPA collected technology performance data from field sampling efforts and from industry-supplied data provided in the Detailed Monitoring Questionnaire. In Chapter 4, EPA presents a detailed description of each data source. While EPA sampling data typically reflects the daily performance of a system over a 5-day period, industry-supplied data for this guideline (collected through the Detailed Monitoring Questionnaire) reflected up to three years of data. The monitoring data obtained through the Detailed Monitoring Questionnaire is unique to each facility in terms of the number of parameters analyzed and the monitoring frequency. Several facilities provided information for dozens of pollutants, while others provided data for only a few parameters. Additionally, monitoring may have been performed weekly, monthly, or quarterly. Wherever possible, when calculating effluent limitations, EPA used a combination of industry-supplied data and EPA sampling data to better account for the variability of the treatment of landfill leachate over time.

EPA used these data to develop long-term average concentrations and variability factors, by pollutant and technology option, for each subcategory. The Agency calculated the final limitations by multiplying long-term average concentrations by the appropriate variability factors. The following paragraphs briefly describe how EPA determined each of these values. As mentioned above, EPA presents the detailed methodology and data in the Statistical Support Document.

11.1.1 Calculation of Long-Term Averages

For each pollutant selected for regulation (see Chapter 7), EPA calculated long-term average effluent concentrations for each regulatory option and subcategory. The first step was to select representative facilities from the EPA database for each option. In Section 11.2, EPA explains the criteria used in facility selection. After selecting the facilities that best represented a technology option, EPA reviewed the influent and effluent data supplied for each of the regulated pollutants. In calculating limitations, the Agency used effluent data from EPA sampling episodes and Detailed Monitoring Questionnaires, but it did not use effluent data from the Detailed Questionnaire. The pollutant data submitted in the Detailed Questionnaire contained the average concentration, the minimum and maximum concentrations, and the number of samples, whereas EPA sampling data and the Detailed Monitoring Questionnaire consisted of individual daily data. In developing limits, EPA calculated the long-term averages and variability factors using individual daily data. Furthermore, summary data (like the data submitted in the Detailed Questionnaire) may obscure the minimum detection levels used in the sampling data. The use of daily data (like the Detailed Monitoring Questionnaire and EPA sampling data) in developing limitations allows EPA to account for concentration values reported at or below the detection limits. EPA set observations below the sample-specific detection level equal to the detection level for the purposes of calculating a facility-level long-term average. In addition, in many cases, EPA considered reported averages from the Detailed Questionnaires redundant because many facilities also reported the daily data from the Detailed Monitoring Questionnaire for the same time period in 1992 and, therefore, EPA would not have used the data in the calculation of limits. However, in determining whether a pollutant was present at treatable levels, EPA relied on data from any of the three pollutant data sources: Detailed Questionnaire, Detailed Monitoring Questionnaire, and EPA analytical sampling episodes. EPA used effluent data from a facility only if sufficient influent data were available to establish the presence of treatable levels of pollutants. In addition, for each of the regulated pollutants, the Agency analyzed all of the selected facilities to determine if the facility was utilizing treatment technologies, apart from those selected as the technology option, that may provide significant removals of that particular pollutant. For example, the data from a facility that employed carbon adsorption (a treatment technology that was not part of a selected technology option) would not be used in the calculation of the limit for a pollutant that may be treated by carbon adsorption. However, if an intermediate data point that preceded carbon adsorption treatment were available for this facility, then EPA did consider the use of that data point to characterize the performance of the treatment system up to that point. Furthermore, EPA edited EPA sampling data according to the criteria outlined in Chapter 4, Section 4.9.

Once EPA selected the facilities and effluent data points, the Agency calculated the average effluent concentration for each regulated pollutant at each facility. For facilities that EPA had data for both five-day EPA sampling and industry-supplied Detailed Monitoring Questionnaires (representing data collected over the course of at least a year), EPA calculated long-term averages separately as long as the dates for the two data sets did not overlap. Therefore, by using both data sets, the long-term average accounted for the variability of leachate over a longer period of time.

The Agency estimated the long-term average for each regulated pollutant for each BPT/BAT facility by fitting a modified delta-lognormal distribution to the daily concentration data. The modified delta-lognormal distribution models the data as a mixture of non-detect observations and measured values that follow a lognormal distribution. The Agency selected this distribution because of the following reasons: (1) the data for many analytes consisted of a mixture of non-detects and measured values that were approximately lognormal, and (2) in cases where there are no non-detects, the distribution is equivalent to the usual two-parameter lognormal. This is the same basic distributional model used by EPA in the final rulemakings for the Organic Chemicals, Plastics and Synthetic Fibers (OCPSF; 40 CFR Part 414) and the Pulp and Paper category (40 CFR Part 430) and for the proposed rulemaking for the Centralized Waste Treatment industrial category (proposed 40 CFR Part 437, 64 FR 2280 January 13, 1999). In the Pulp and Paper and the Centralized Waste Treatment studies, the modified delta-lognormal distribution assumes that all non-detects have a value equal to the reported sample-specific detection levels and that the detected values follow a lognormal distribution. EPA again used this model as the basis of estimates of the long-term average at a landfill facility. In the case of the OCPSF rule, EPA used the same basic model but the reported non-detect values were set equal to the pollutant analytical minimum level. A more detailed discussion of the modified delta-lognormal distribution can be found in the "Statistical Support Document for the Final Effluent Limitations Guidelines and Standards for the Landfills Point Source Category" (EPA-821-B-99-007).

After EPA developed the facility-level long-term averages for each regulated pollutant using the criteria outlined above, the Agency determined the median of the facility-level long-term averages for each regulated pollutant in each subcategory. The median of the facility-level long-term averages for each regulated pollutant was the long-term average used in the calculation of the effluent limitation as described later in this section.

11.1.2 Calculation of Variability Factors

EPA calculated variability factors using the same data sets used to derive the long-term average values. As with the calculation of the long-term averages, EPA fit the daily concentration data to a modified delta-lognormal distribution. The Agency calculated separate variability factors for different averaging periods (either 1-day, 4-day, or 20-day averages). Thus, EPA applied different variability factors to daily data (single measurements without averaging) and to monthly-average data based on four measurements taken once per week ("4-day averages") or 20 measurements taken once each day, five days a week throughout a month ("20-day average").

For those facility data sets that had at least four observations for a given regulated pollutant, including two detected values, EPA used the modified delta-lognormal model to estimate daily and 4-day or 20-day average variability factors. There were several instances where EPA could not calculate variability factors from the landfills database because EPA measured fewer than two samples above the detection limit. In these cases, the Agency transferred variability factors from biological treatment systems used in the final rulemaking of the OCPSF guideline (40 CFR Part 414).

As stated above, in calculating the variability factors, EPA assumed a log-normal distribution of the data. In addition, the Agency used the following:

- The 95th percentile to establish the maximum monthly average.
- The 99th percentile to establish the maximum for any one day.

EPA defines the daily variability factor as the ratio of the estimated 99th percentile of the distribution of daily values to the estimated mean of the distribution. Similarly, the Agency defines the monthly variability factor as the estimated 95th percentile of the distribution of 4-day or 20-day averages divided by the estimated mean of the monthly averages. EPA derived a monthly-average and daily-maximum variability factor for each pollutant and for each regulatory option. For each subcategory, the Agency defined the daily variability factor for each pollutant as the average of the facility-level daily variability factor. Likewise, EPA defines the 4-day average variability factor for each pollutant as the average of the facility-level 4-day average variability factors and the 20-day average variability factor for each pollutant as the average of the facility-level 20-day average variability factors.

11.1.3 Calculation of Effluent Limitations

The Agency used the median long-term average and the average variability factor for each pollutant in the calculation of the effluent limitations. For each subcategory, EPA calculated the daily-maximum limitations by multiplying the median of the long-term average for a given pollutant by the average daily variability factor for that pollutant. EPA calculated the monthly-maximum limitations by multiplying the median long-term average for a given pollutant by the average 4-day or 20-day variability factors for that pollutant. The Agency used twenty-day average limitations for the conventional pollutants, BOD_5 and TSS, and four-day average limitations for other nonconventional and toxic pollutants.

11.2 Best Practicable Control Technology Currently Available (BPT)

EPA promulgated BPT effluent limitations for the Subtitle D Non-Hazardous and Subtitle C Hazardous subcategories. BPT effluent limitations control identified conventional, toxic, and nonconventional pollutants when discharged from landfill facilities to surface waters of the U.S. Generally, EPA determines BPT effluent levels based on the average of the best existing performance by facilities of various sizes, ages, and unit processes within an industrial category or subcategory. In industrial categories where present practices are uniformly inadequate, however, EPA may determine that BPT requires higher levels of control than any currently in place if the technology to achieve those levels can be practicably applied. BPT may be transferred from a different category or subcategory. BPT normally focuses on end-of-process treatment rather than process changes or internal controls, except when these technologies are common industry practice.

In addition, the Clean Water Act (CWA) Section 304(b)(1)(B) requires a cost-reasonableness assessment for BPT limitations. In determining the BPT limits, EPA must consider the total cost of treatment technologies in relation to the effluent reduction benefits achieved. This inquiry does not limit EPA's broad discretion to adopt BPT limitations that are achievable with available technology unless the required additional reductions are "wholly out of proportion to the costs of achieving such marginal level of reduction." A Legislative History of the Water Pollution Control Act Amendments of 1972, p. 170. Moreover, the inquiry does not require the Agency to quantify benefits in monetary terms. See e.g. *American Iron and Steel Institute* v. *EPA*, 526 F. 2d 1027 (3rd Cir., 1975).

In assessing the costs relative to the benefits of effluent reduction, EPA considers the volume and nature of expected discharges after application of BPT, the general environmental effects of pollutants, and the cost and economic impacts of the required level of pollution control. In developing guidelines, the Act does not require or permit consideration of water quality problems attributable to particular point sources, or water quality improvements in particular bodies of water. Therefore, EPA has not considered these factors in developing the final limitations. See *Weyerhaeuser Company* v. *Costle*, 590 F. 2d 1011 (D.C. Cir. 1978).

In setting BPT limitations based on a treatment technology, EPA does not require the use of that technology to treat landfill wastewater. Rather, to establish the limits, EPA has demonstrated that the concentration limits are achievable based on a well-operated system using selected technologies. The technologies that may be used to treat wastewater are left entirely to the discretion of the individual landfill operator, as long as the numerical discharge limits are achieved.

11.2.1 BPT Technology Options for the Subtitle D Non-Hazardous Subcategory

In the Agency's engineering assessment of the best practicable control technology currently available for treatment of wastewater from landfills, EPA first considered three technologies commonly in use by landfills and other industries as options for BPT: chemical precipitation, biological treatment, and multimedia filtration.

For its evaluation of chemical precipitation, EPA collected raw wastewater and treated effluent data from several non-hazardous landfills employing this technology. Based on these data, EPA removed chemical precipitation from further consideration as a BPT treatment option. While chemical precipitation is an effective treatment technology for the removal of metals, non-hazardous landfills typically have low concentrations of metals in treatment system influent wastewater. Observed metals concentrations were typically not found at levels that would inhibit biological treatment or that would be effectively removed by a chemical precipitation unit.

EPA sampling data collected at facilities in the Non-Hazardous subcategory showed relatively low levels (less than 1 mg/L) of pollutant of interest metals in untreated landfill generated wastewater. Furthermore, Table 11-1 presents several sources of performance data for metals removals in activated sludge systems along with published biological treatment inhibition ranges and raw wastewater characteristics from the non-hazardous facilities in the EPA database. Performance data for metals from biological treatment systems were obtained from the National Risk Management Research Laboratory (NRMRL) Treatability Database (formerly called the Risk Reduction Engineering Laboratory (RREL) Treatability Database), the 50-POTW Study, and a sampling program conducted at twelve OCPSF facilities that have biological treatment systems. Metal concentrations in the raw wastewater for this subcategory are below, or close to, the published inhibition levels for biological treatment systems. A review of performance data indicates that certain pollutant of interest metals, such as chromium and zinc, are removed by well-operated biological treatment processes at relatively high rates. See Table 11-1.

Based on this analysis, EPA concluded that pollutant of interest metals observed in the Non-Hazardous subcategory generally are present in landfill generated wastewater at levels that should not effect the operation and performance of a biological treatment system. Under these circumstances, biological treatment removes the metals identified as pollutants of interest in the Non-Hazardous subcategory. Therefore, EPA concluded that biological treatment is an adequate BPT control technology for pollutant of interest metals in the Non-Hazardous subcategory.

Based on the above assessment, EPA developed the following BPT regulatory options. Chapter 8 discusses these two technology options in detail and Chapter 9 discusses the cost estimates developed for these options.

Non-Hazardous Subcategory Option I: Biological Treatment

EPA first assessed the pollutant removal performance of equalization and biological treatment. EPA evaluated this as Option I due to its effectiveness in removing the large organic loads commonly associated with leachate. BPT Option I consists of aerated equalization followed by biological treatment. EPA included various types of biological treatment such as activated sludge, aerated lagoons, and anaerobic and aerobic biological towers or fixed film reactors in calculating limits for this option. The Agency based the costs for Option I on the cost of aerated equalization followed by an extended aeration activated sludge system and clarification, including sludge dewatering. Figure 11-1 presents a flow diagram of the treatment system costed for Option I. Approximately thirty percent of the direct-discharging municipal solid waste landfills employed some form of biological treatment, and fifteen percent had a combination of equalization and biological treatment.

Non-Hazardous Subcategory Option II: Biological Treatment and Multimedia Filtration

The second technology option considered for BPT treatment of non-hazardous landfill wastewater was equalization prior to biological treatment, followed by secondary clarification and multimedia filtration. EPA evaluated this as Option II due to its effectiveness in removing the large organic loads and suspended solids commonly associated with leachate. Approximately nine percent of the direct discharging non-hazardous facilities used the technologies described in Option II. EPA based cost estimates for Option II on the cost of Option I plus a multimedia filtration system. Figure 11-2 presents a flow diagram of the treatment system costed for this option.

Selected BPT Technology Option

EPA selected Option II, equalization prior to biological treatment followed by secondary clarification and multimedia filtration, as the technology basis for BPT limitations for the Non-Hazardous landfills subcategory. EPA selected Option II for the basis of BPT limitations because of the demonstrated ability of biological treatment systems in controlling organics and the effectiveness of multimedia filtration in removing TSS. EPA's decision to base BPT limitations on Option II treatment primarily reflects two factors: the degree of effluent reductions attainable and the total cost of the treatment technologies in relation to the effluent reductions achieved. In assessing BPT, EPA considered the age, size, process, other engineering factors, and non-water quality impacts pertinent to the facilities treating wastes in this subcategory. No basis could be found for identifying different BPT limitations based on age, size, process or other engineering factors. Neither the age nor the size of the landfill facility will directly affect the treatability of the landfill wastewater, as discussed in Chapter 5. For the non-hazardous landfills, the most pertinent factors for establishing the limitations are costs of treatment and the level of effluent reductions obtainable.

EPA has selected Option II based on the comparison of the two options in terms of total costs of achieving the effluent reductions, pounds of pollutant removals, economic impacts, and general environmental effects of the reduced pollutant discharges. BPT Option II removed significantly more pounds of conventional pollutants than Option I with only a moderate associated cost increase. EPA estimated that BPT Option II will cost $340,000 (1998 dollars) more annually than BPT Option I for an additional removal of 142,000 pounds of conventional pollutants (mainly TSS).

Finally, EPA analyzed the costs of both options to determine the economic impact that this rule would have on the Landfills industry. EPA's assessment showed that, under either option, only two facilities would incur significant economic impacts. For this assessment, EPA defined significant economic impacts in two different ways, depending on the ownership of the facility. For privately-owned facilities, significant economic impacts exist when the facility's after-tax cash flow is negative following the addition of compliance costs. For municipally-owned facilities, significant economic impacts occur when the ratio of compliance costs to median household income are greater than one percent. The economic assessment for the final rule is described in the "Economic Analysis for the Final Effluent Limitations Guidelines and Standards for the Landfills Point Source Category." (EPA-821-B-99-005).

11.2.2 BPT Limits for the Subtitle D Non-Hazardous Subcategory

Selection of BPT Facilities

EPA based the final BPT effluent limitations for the Non-Hazardous subcategory on the average of the best existing wastewater treatment systems. The first criterion used in the selection of the average of the best facilities was effective treatment of BOD_5. In selecting BPT facilities, EPA identified facilities that employed either Option I or Option II technologies. Even though EPA selected Option II technologies as the basis for developing the BPT effluent limitations, EPA assumed that very little additional BOD_5 removal would occur because of the multimedia filter employed in Option II and, therefore, facilities employing biological treatment only (Option I) could achieve good removal of BOD_5 and be considered BPT. However, in determining the BPT effluent limitations for TSS, EPA only used the data from the best performers using the entire BPT Option II technology (biological treatment plus a filter) because of the multimedia filtration system's effectiveness in removing suspended solids.

There were 45 municipal solid waste landfill facilities (see Table 11-2) in the EPA database in the Non-Hazardous subcategory that utilized a biological treatment system that was considered for BPT. Even though both Subtitle D municipal solid waste landfills and non-municipal solid waste landfills make up the Non-Hazardous subcategory, EPA only considered municipal solid waste facilities for selection as BPT for the Non-Hazardous subcategory because the wastewater at these landfills tends to contain a wider array of pollutants than that found at Subtitle D non-municipal facilities. The pollutants found at the non-municipal facilities tended to be a subset of the pollutants found at the municipal facilities. In fact, all nine pollutants of interest for non-municipal facilities were also pollutants of interest for the municipal facilities (see Chapter 7). In addition, EPA's data showed that the pollutants of interest present at non-municipal facilities were present at concentrations similar to, or less than, the concentrations typically found at municipal facilities. Therefore, EPA determined that a treatment system that can adequately control pollutant discharges from a municipal solid waste landfill should also be able to control discharges at Subtitle D non-municipal landfills. EPA discusses its reasons for establishing only one subcategory for non-hazardous landfills in Chapter 5 and discusses alternative technology options and costs of these options in Chapters 8 and 9, respectively.

In addition to the 45 non-hazardous municipal solid waste facilities identified as potential BPT, EPA also evaluated one hazardous facility (16041) in the EPA database. This facility used biological treatment in the form of a sequential batch reactor (SBR) to treat its landfill generated wastewater. The facility commingled leachate from both non-hazardous and hazardous landfills prior to treatment by the SBR. In determining whether it was reasonable to include a facility from the Hazardous subcategory as a potential BPT facility in the Non-Hazardous subcategory, EPA evaluated two different factors. First, because the facility accepted leachate from both hazardous and non-hazardous landfills, EPA sampling data showed that the waste stream contained almost all of the pollutants of interest for the Non-Hazardous subcategory at similar concentrations to those found in the non-hazardous landfill raw wastewater database (see Table 11-3). At this facility, EPA sampling detected all but one of the 32 pollutants of interest for the Non-Hazardous subcategory in the influent concentration (1,4-dioxane) and EPA did not include four others (barium, disulfoton, hexavalent chromium, and n,n-dimethylformamide) in the analytical effort. Therefore, the Agency determined that the raw wastewater concentrations for the non-hazardous pollutants of interest from this hazardous facility were similar to those concentrations found at the non-hazardous facilities. Second, the facility achieved good BOD_5 removal using biological treatment equivalent to BPT Option I.

Therefore, EPA concluded that a treatment system that can adequately control pollutant discharges from a hazardous landfill should also be able to control discharges at non-hazardous landfills.

Based on the assessment above, there were 46 in-scope landfill facilities in the EPA database that employed various forms of biological treatment considered for BPT for the Non-Hazardous subcategory. EPA evaluated these 46 landfill facilities selected as potential BPT candidates to determine the performance across the various types of biological treatment systems. To determine the best performers for biological treatment EPA established a number of criteria. The first criterion used in the selection of the best facilities was effective treatment of BOD_5. Under this criterion, there were several reasons why a facility might be eliminated from the selection of BPT facilities.

Of the 46 landfill facilities treating their wastewater with some form of biological treatment, only 26 facilities provided BOD_5 effluent data in their Detailed Questionnaire or Detailed Monitoring Questionnaire submitted to EPA or in the data that EPA collected during a sampling episode performed at the facility. EPA evaluated these data to assess the performance across the various biological systems. Two facilities, 16119 and 16123, provided carbonaceous BOD (CBOD) data rather than BOD_5 data and, therefore, EPA removed these facilities from further consideration. EPA eliminated the facilities reporting CBOD data because the analytical results of the CBOD tests can differ from the BOD_5 results, especially in cases where ammonia is present in the wastewater. Table 11-4 lists the 20 facilities that EPA eliminated from further consideration as BPT facilities since they did not supply BOD_5 effluent data. Table 11-5 lists the treatment in place at the 26 candidate BPT facilities in the Non-Hazardous subcategory that provided BOD_5 effluent data. Table 11-6 shows, for the 26 candidate BPT facilities, the baseline flow, the facility-average raw wastewater BOD_5 concentration, the facility-average effluent BOD_5 concentration, the influent and effluent BOD_5 concentrations from Section C of the Detailed Questionnaire (DET) data, Detailed Monitoring Questionnaire (DMQ) data, and EPA sampling episodes (ANL) data, and the reason (if any) why EPA eliminated the facility as a BPT facility. EPA determined the average raw wastewater BOD_5 concentration and average effluent BOD_5 concentration at a facility by calculating the flow-weighted average of the facility data available in Section C of the Detailed Questionnaire, the Detailed Monitoring Questionnaire, and the data collected during the EPA sampling episode.

Because EPA based BPT limitations on the effectiveness of biological treatment, the Agency eliminated facilities that used additional forms of treatment for BOD_5 (other than biological treatment). EPA, therefore, removed two sites (16099, 16125) using carbon treatment in addition to biological treatment from the list of candidate BPT facilities. EPA eliminated another facility from consideration (16117) because it used two separate treatment trains in treating its wastewater, one with biological treatment and the other with chemical precipitation, before commingling the streams at the effluent sample point. After the elimination of these three facilities, 23 potential BPT facilities remained in the EPA non-hazardous landfill database.

To ensure that the facilities were operating effective biological treatment systems, EPA evaluated the influent concentrations of BOD_5 entering the wastewater treatment systems to determine which facilities had influent BOD_5 concentrations that most closely resembled typical non-hazardous landfills. The median concentration of BOD_5 for non-hazardous landfills was 240 mg/L and the average concentration was 1,229 mg/L. EPA determined that facilities with BOD_5 influent concentrations significantly lower than these values would not be representative of typical wastewater concentrations found in the Non-Hazardous subcategory. Therefore, EPA eliminated facilities where the influent BOD_5 was below 100 mg/L. EPA acknowledges that it is possible to operate a biological treatment system with influent BOD_5 concentrations lower than 100 mg/L. In fact, as can be seen in Table 11-6, four of the remaining candidate BPT facilities had influent BOD_5 concentrations much less than 100 mg/L (16077, 16093, 16097, and 16170) and operated biological treatment systems. Three of these four (16077, 16093, 16097) achieved BOD_5 effluent concentrations below the BPT effluent limit despite low influent BOD_5 concentrations. However, EPA did receive a significant number of comments on the proposal stating that the biological treatment option selected as BPT was infeasible for treatment of particular types of landfill leachate (ash monofill wastewater in particular) due to its low organic content. The BOD_5 raw wastewater data submitted by some of these commenters was below 10 mg/L. The Agency acknowledges that in many of these cases (such as where BOD_5 is less than 10 mg/L), the concentration of organic material in the raw wastewater is too low to support biological treatment. Because the guidelines do not require the installation of any particular technology to meet the limitations, facilities remain free to use whatever technology they choose as long as these technologies can meet the limitations. In response to comments concerning the feasibility of biological treatment for certain types of monofills with very low BOD_5 in their raw leachate, the Agency developed costs for low BOD_5 facilities in the database for alternative, non-biological treatment such as breakpoint chlorination, granular activated carbon, and iron co-precipitation. These alternate forms of non-biological treatment are discussed in Chapter 8 and their associated costs presented in Chapter 9. EPA's decision not to further subcategorize the Non-Hazardous landfill subcategory is discussed in Chapter 5. Therefore, as a result of the influent BOD_5 greater than 100 mg/L edit, EPA did not consider four facilities (16077, 16093, 16097, and 16170) for BPT.

EPA eliminated eight other facilities (16048, 16049, 16052, 16065, 16161, 16164, 16171, and 16176) from BPT consideration because they did not supply BOD_5 influent data (from any data source). EPA did not select two facilities (16127 and 16129) because their raw wastewater streams consisted primarily of non-contaminated storm water or contaminated ground water, which are flows that this regulation does not cover. As discussed in Chapter 6, the Agency did not use monitoring data to characterize landfill generated wastewater from facilities where out-of-scope wastewater contributed greater than 15 percent of the total wastewater flow. Facility 16129 treated a combined raw wastewater influent stream consisting of 92 percent ground water and 7 percent leachate, and facility 16127 treated a combined raw wastewater influent stream consisting of 70 percent storm water and 30 percent leachate. After elimination of these facilities, a total of 9 candidate BPT facilities remained.

The final requirement for BPT selection in the Non-Hazardous landfill subcategory was that the biological treatment system at the facility had to achieve a BOD_5 effluent concentration less than 50 mg/L. EPA determined that facilities not able to maintain an effluent concentration below 50 mg/L were not operating their biological system effectively. Two of the remaining 9 facilities (16088 and 16165) did not achieve

BOD_5 effluent concentrations of less than 50 mg/L, leaving seven facilities in the database. The site-identification numbers for the seven facilities selected as BPT are 16041, 16058, 16118, 16120, 16122, 16132, and 16253.

The seven facilities that met all of the BPT criteria employed various types of biological treatment systems, including activated sludge, a sequential batch reactor, aerobic and anaerobic biological towers or fixed film, and aerated ponds or lagoons. Most of the facilities employed equalization tanks in addition to the biological treatment, while several facilities also employed chemical precipitation and neutralization in their treatment systems. Clarification or sedimentation stages followed the biological treatment systems. Table 11-7 shows the treatment technologies in-place at the facilities selected as BPT for the Non-Hazardous subcategory. EPA used all seven facilities employing well-operated biological treatment systems to calculate the effluent limitations for BOD_5. The average influent BOD_5 concentrations to these seven treatment systems ranged from 150 mg/L to 7,600 mg/L and, as mentioned above, all of the average effluent concentrations for these seven facilities were below 50 mg/L.

While the BOD_5 edits discussed above ensure good biological treatment and a basic level of TSS removal, treatment facilities meeting this level may not necessarily be operated for optimal control of TSS. To ensure that the effluent limitation developed for TSS reflects proper control, EPA established additional editing criteria for TSS.

EPA developed two criteria for editing TSS performance data. In addition to achieving the BOD_5 criteria cited above, EPA required that the facility employ technology sufficient to ensure adequate control of TSS, that is, a sand or multimedia filtration system. Three of the seven well-operated biological systems (16120, 16122, 16253) used sand or multimedia filters as a polishing step for additional control of suspended solids prior to discharge.

The second factor EPA considered was whether the treatment system achieved an effluent TSS concentration less than or equal to 100 mg/L. EPA selected treatment facilities meeting these criteria as the average of the best existing performers for TSS. Table 11-8 lists the baseline flow, the facility-average raw wastewater TSS concentration, the facility-average effluent TSS concentration, the influent and effluent TSS concentrations from Section C of the Detailed Questionnaire (DET) data, the Detailed Monitoring Questionnaire (DMQ) data, and the EPA sampling episode (ANL) data for the seven facilities selected as BPT in the Non-Hazardous subcategory. EPA determined the average raw wastewater TSS concentration and average effluent TSS concentration at a facility by calculating the flow-weighted average of the facility data available in Section C of the Detailed Questionnaire, the Detailed Monitoring Questionnaire, and the data collected during the EPA sampling episode. All three facilities that employed a sand or multimedia filtration system (16120, 16122, and 16253) achieved an effluent TSS concentration far less than 100 mg/L, and therefore EPA included these among the best existing performers for TSS. Although facility 16122 meets the TSS editing criteria, EPA eliminated it from further consideration as BPT for TSS because of potential settling of TSS in aerated tanks immediately prior to the filters that are not part of the selected BPT option. Therefore, EPA selected the remaining two facilities (16120 and 16253) as "average of the best" existing performers for TSS and based the TSS limitations on these two facilities.

EPA determined that the use of a multimedia filter after biological treatment with secondary clarification achieved significantly lower long-term average effluent concentrations of TSS than the other BPT facilities that did not employ multimedia filters after secondary clarification. As shown in Table 11-8, the two facilities (16120 and 16253) that employed multimedia filters after biological treatment with clarification achieved an average effluent TSS concentration of 19.5 mg/L whereas the other BOD_5 BPT facilities without multimedia filters achieved an average effluent concentration of 69.1 mg/L.

<u>Development of BPT Limitations</u>

EPA based the effluent limitations for BOD_5 on all seven non-hazardous BPT facilities; however, the BPT facilities often did not supply data for all of the regulated pollutants. Therefore, EPA used the data available from the seven non-hazardous BPT facilities to develop the BPT limitations for ammonia, TSS, alpha terpineol, benzoic acid, p-cresol, phenol, and zinc. EPA applied additional editing criteria to the seven BPT facilities to select the "average of the best" existing performers for each of the regulated pollutants. The editing criteria applied to the available data were as follows:

- EPA only used data from the seven facilities which passed the BOD_5 criteria in the calculation of limits (16041, 16058, 16118, 16120, 16122, 16132, and 16253).

- EPA only used data from facilities that passed the TSS criteria in the calculation of TSS limits (16120 and 16253).

- EPA did not use effluent data from the Detailed Questionnaire (16000 series data) in the calculation of effluent limits. The pollutant data submitted in the Detailed Questionnaire contained the average concentration, the minimum and maximum concentrations, and the number of samples, whereas EPA sampling data and the Detailed Monitoring Questionnaire consisted of individual daily data. In developing limits, EPA calculated the long-term averages and variability factors using individual daily data. Furthermore, summary data (like the data submitted in the Detailed Questionnaire) may obscure the minimum detection levels used in the sampling data. The use of daily data (like the Detailed Monitoring Questionnaire and EPA sampling data) in developing limitations allows EPA to account for concentration values reported at or below the detection limits. In addition, in many cases, EPA considered reported averages from Detailed Questionnaires redundant because many facilities also reported the daily data from the Detailed Monitoring Questionnaire for the same time period in 1992 and, therefore, EPA would not have used the data in the calculation of limits. However, EPA did use, in cases where no other influent data were available, influent data from the Detailed Questionnaire to show that a landfill had treatable levels of a pollutant in the wastewater.

- Since chemical precipitation was not part of the selected BPT Option for the Non-Hazardous subcategory, EPA did not use data from BPT facilities employing chemical precipitation when developing limitations for metals. Therefore, since zinc was the only metal regulated, EPA did not include zinc effluent data from four of the seven facilities that employed chemical precipitation in the calculation of zinc limitations (16118, 16120, 16122, and 16253). In the Non-Hazardous subcategory, EPA determined that the levels of zinc found in raw wastewater were at low enough concentrations that chemical precipitation was not a necessary treatment technology. In the Non-Hazardous landfill subcategory, EPA's sampling, for the most part, did not find zinc raw wastewater concentrations that would inhibit biological treatment. In addition, raw wastewater concentrations of zinc were typically less than 1 mg/L, a level that would not be effectively removed by a chemical precipitation system.

- EPA did not use facility data demonstrating zero or negative percent removals in the calculation of limits. No facility data in the Non-Hazardous subcategory met this criterion.

- EPA did not include data from facility 16120 in the calculation of ammonia limitations because the treatment system included air stripping.

- EPA only used effluent data if sufficient influent data were available to establish the presence of treatable levels of pollutants. The Agency only used effluent data in calculating limits if influent data for a given pollutant were available for a facility. In cases where a facility supplied effluent data for a particular pollutant but did not supply influent data in the Detailed Monitoring Questionnaire (or supplied influent data below a treatable level), EPA used the effluent data so long as influent data were available from the EPA sampling episode or the Detailed Questionnaire at a concentration above a treatable level. However, EPA did not use effluent data from EPA sampling episodes to calculate limits unless matching influent data from the EPA sampling episode were at concentrations above treatable levels.

- For the EPA sampling episode at facility 16122, EPA did not use the effluent data collected from sample point 08 in the calculation of the limits because this sample point was located after two aerated holding tanks operated in parallel just prior to the multimedia filter (which was not part of the selected treatment option after biological treatment). Instead, EPA used data from sample point 07 (after biological treatment but before aeration in the holding tanks) in the calculation of limits for the final rule. In addition, EPA did not use effluent data from the Detailed Questionnaire and Detailed Monitoring Questionnaire from facility 16122 in the calculation of limits because the data were from sample point 03, which is located after the aeration tanks.

In Table 11-9, EPA presents the non-hazardous BPT facilities and sample points used to calculate the non-hazardous BPT limitations for conventional, nonconventional, and toxic pollutants. Table 11-10 presents the non-hazardous BPT facilities and sample points that EPA did not use to calculate the BPT limitations and the reason for their exclusion. Table 11-11 presents EPA's final BPT limitations for the Non-Hazardous subcategory.

Tables 11-12 and 11-13 present the national estimates of the pollutant of interest reductions for the BPT/BAT options for the municipal solid waste Subtitle D landfills and non-municipal Subtitle D landfills, respectively. Table 11-14 and Table 11-15 summarize the estimated amount of pollutants discharged annually from direct discharging municipal landfills and direct-discharging non-municipal landfills, respectively, before and after the implementation of BAT for the Non-Hazardous subcategory.

EPA based all of the estimated costs on a facility installing aerated equalization tanks followed by an activated sludge biological system with clarification and a multimedia filter and included a sludge dewatering system. On a national scale, EPA estimates that the implementation of the BAT effluent limitations will require a capital cost of $18.87 million and annual operating cost of $6.50 million resulting in a total annualized cost of $7.64 million (post-tax) for the Subtitle D Non-Hazardous subcategory (1998 dollars).

11.2.3 BPT Technology Options for the Subtitle C Hazardous Subcategory

EPA's survey of the hazardous landfills industry identified no in-scope respondents that were classified as direct dischargers. All of the hazardous landfills within the scope of the rule are either indirect or zero/alternative dischargers. Consequently, EPA could not evaluate any treatment systems in-place at direct-discharging hazardous landfills for establishing BPT effluent limitations. Therefore, EPA relied on information and data from widely available treatment technologies in use at hazardous landfill facilities discharging indirectly and at non-hazardous landfills discharging directly and indirectly, termed "technology transfer." EPA concluded that the technology in-place at some indirect hazardous landfills is appropriate to use as the basis for regulation of direct dischargers because the wastewater generated at hazardous waste landfills discharging directly would be similar in character to the wastewater from indirect-discharge hazardous waste landfills.

Based on this assessment, EPA developed the following BPT regulatory options for establishing BPT effluent limitations for the Hazardous landfill subcategory: 1) aerated equalization followed by chemical precipitation with clarification and multimedia filtration, 2) aerated equalization followed by chemical precipitation with clarification, biological treatment with secondary clarification, and multimedia filtration, and 3) zero or alternative discharge. Chapter 8 discusses these options in detail and Chapter 9 discusses the cost estimates developed for these options.

Hazardous Subcategory Option I: Chemical Precipitation and Multimedia Filtration

EPA first assessed the pollutant removal performance of equalization, chemical precipitation, and multimedia filtration. EPA evaluated chemical precipitation as a treatment technology because of the metals concentrations typically found in hazardous landfill leachate and the efficient metals removals achieved through chemical precipitation. EPA also evaluated multimedia filtration as an appropriate technology to remove additional levels of metals and TSS following chemical precipitation.

Hazardous Subcategory Option II: Chemical Precipitation, Biological Treatment, and Multimedia Filtration

The second technology option considered for BPT treatment of hazardous landfill wastewater was aerated equalization, chemical precipitation, and biological treatment with secondary clarification, followed by multimedia filtration. EPA evaluated these technologies as Option II because of the effectiveness of chemical precipitation in removing metals and the effectiveness of biological treatment in removing the high organic loads present in the leachate. The Agency considered multimedia filtration to be an appropriate technology for consideration because of its effectiveness in removing TSS and metals remaining after primary or secondary clarification.

Hazardous Subcategory Option III: Zero or Alternative Discharge

Finally, EPA considered a zero or alternative discharge option as BPT Option III because a significant segment of the industry is currently not discharging wastewater to surface waters or to POTWs. The zero or alternative disposal option would require facilities to dispose of their wastewater in a manner that would not result in wastewater discharge to a surface water or a POTW.

Methods of achieving zero or alternative discharge currently in use by hazardous landfills are deep well injection, solidification, and contract hauling of wastewater to a Centralized Waste Treatment (CWT) facility or to a landfill wastewater treatment facility. Thirty seven facilities are estimated to inject landfill wastewater underground on site, 103 facilities send their wastewater to a CWT or landfill treatment system, and one facility solidifies wastewater.

Selected BPT Technology Option

EPA selected Option II, aerated equalization and chemical precipitation followed by biological treatment with secondary clarification and multimedia filtration, as the technology basis for BPT limitations for the Hazardous landfills subcategory. EPA selected Option II because of the demonstrated ability of biological treatment and multimedia filtration in removing the large organic loads and suspended solids associated with hazardous leachate. Metals in the raw wastewater will be removed prior to the biological treatment system using chemical precipitation. Figure 11-3 presents a flow diagram of the treatment system for this option.

EPA eliminated Option I from consideration because it did not control organic pollutants effectively. In addition, based on consideration of comments submitted on the proposal, EPA decided not to establish BPT limitations based on zero or alternative discharge. EPA concluded that, for the industry as a whole, zero or alternative discharge options are either not viable or the cost is wholly disproportionate to the pollutant reduction benefits and, thus, not "practicable." Furthermore, the commenters' submissions support EPA's decision to reject zero or alternative discharge as the technology basis for BPT (or BAT) limitations for hazardous landfills. While EPA supports the use of zero or alternative discharges particularly where it does not result in media transfer of pollutants, many of the available zero discharge options have identifiable shortcomings, such as transfer of waste residuals to another media (e.g., ground water, soil) or the availability of an alternative disposal option only in certain geographic locations.

For example, one demonstrated alternative disposal option for large wastewater flows is underground injection. However, this is not considered a practically available option on a nationwide basis because it is not allowed in many geographic regions of the country where landfills may be located. These restrictions may preclude underground injection at a given landfill. In such circumstances, landfills would need to resort to contract hauling to a CWT facility. Unless the CWT itself were a zero discharge facility, the ultimate result would be treatment and discharge to surface waters or a POTW following waste treatment that may be no more effective than that provided on site. This might result in substantial transportation costs for the landfill and associated non-water quality environmental impacts (e.g., truck emissions) resulting in no net reduction in the discharge of pollutants. EPA's survey demonstrated that only landfills with relatively low flows (under 500 gpd) currently contract haul their wastewater to a CWT. The costs of contract hauling are directly proportional to the volume and distance over which the wastewater must be transported, generally making it excessively costly to send large wastewater flows to a CWT, particularly if it is not located nearby.

EPA evaluated the cost of requiring all hazardous landfills to achieve zero or alternative discharge status. For the purposes of costing, EPA assumed that a facility would have to contract haul wastewater off site because it may be impossible to pursue other zero or alternative discharge options. EPA concluded that the cost of contract hauling off site for high flow facilities was unreasonably high and disproportionate to the removals potentially achieved. In addition, EPA concluded that the wastewater shipped to a CWT will typically receive treatment equivalent to that promulgated, and that zero/alternative discharge requirements would result in additional costs to discharge without greater removals for hazardous landfill wastewater. To calculate costs for this option, EPA estimated that all facilities currently discharging to a POTW would have to contract haul wastewater approximately 500 miles to a CWT facility. EPA based cost estimates on a $0.35 per gallon disposal cost at a CWT facility, and $3.00 per loaded mile for transport. EPA estimated the total cost to the industry at approximately $30 million dollars.

11.2.4 BPT Limits for the Subtitle C Hazardous Subcategory

<u>Selection of BPT Facilities</u>

EPA based the BPT effluent limitations for the Hazardous subcategory upon the average of the best existing landfill facilities. Based on the characteristics of hazardous landfill leachate and on an evaluation of appropriate technology options, the Agency selected aerated equalization, chemical precipitation, and biological treatment followed by secondary clarification and multimedia filtration as BPT technology for the Hazardous subcategory. As previously noted, EPA relied on data from both hazardous and non-hazardous facilities to develop the limitations for this subcategory. Because there are currently no hazardous landfills discharging directly, EPA used data from indirectly discharging facilities to develop the limitations.

Apart from the 139 hazardous, zero, or alternative discharge facilities estimated to be in the U.S. based on the responses to the Detailed Questionnaire, EPA identified only three other hazardous respondents (16017, 16041, and 16087) to the Detailed Questionnaire, all of which discharged indirectly to POTWs. Facility 16017 only collected and treated landfill gas collection condensate which was very dilute, had low flows, and required only minimal treatment (neutralization using ammonia) prior to discharge. Consequently, EPA did not consider this facility as appropriate for establishing BPT limitations. The two remaining facilities (16041 and 16087) both had treatment systems in-place that achieved very good pollutant reductions. The treatment at facility 16087 consisted of equalization and a chemical precipitation unit followed by an activated sludge system with secondary clarification; the other facility (16041) utilized equalization tanks and a sequential batch reactor. The treatment systems in-place at these indirect-discharging hazardous facilities achieved low effluent concentrations with average removals of 88 to 98 percent of organic toxic pollutants, and 55 to 80 percent of metal pollutants. Thus, EPA concluded that both facilities should be used in the development of the Hazardous subcategory BPT limitations for nonconventional and toxic pollutants. Table 11-16 presents the treatment technologies in-place at the facilities selected as BPT for the Hazardous subcategory.

Development of BPT Effluent Limitations

As discussed above, because there were no direct-discharging hazardous facilities in EPA's database, the Agency relied on technology transfer to establish BPT effluent limitations, using performance data from treatment technologies at hazardous landfill facilities discharging indirectly and non-hazardous facilities discharging directly and indirectly. EPA used the data from the two hazardous indirect-discharging facilities (16041 and 16087) to calculate the BPT effluent limitations for the following toxic pollutant parameters:

alpha terpineol, aniline, arsenic (total), benzoic acid, chromium (total), naphthalene, p-cresol, phenol, pyridine, and zinc (total). Chapter 7 discusses the methodology used to select toxic pollutants for regulation.

EPA concluded that establishing BPT effluent limitations for ammonia, BOD_5, and TSS based only on performance data from these two hazardous indirect-discharging facilities was not appropriate. In general, removal of classical pollutant parameters such as ammonia, BOD_5, and TSS in treatment systems at indirect-discharging facilities is incidental to toxic pollutant removals, since these pollutants are a major component of domestic sewage and are adequately treated at POTWs. Since removals of ammonia, BOD_5, and TSS at these two hazardous indirect-discharging facilities ranged from poor to adequate, EPA concluded that the use of performance data from BPT facilities in both the Hazardous and Non-Hazardous subcategories that employed variations of biological treatment would result in more representative hazardous BPT effluent limitations for these pollutants.

EPA supplemented the Hazardous subcategory data for these three pollutants with data from non-hazardous landfill facilities. For calculation of BPT effluent limitations for BOD_5, EPA supplemented the performance data from the two hazardous indirect-discharging facilities (16041 and 16087), with performance data from direct- and indirect-discharging non-hazardous facilities (16058, 16118, 16120, 16122, 16132 and 16253) to obtain a more representative mix of facilities. For calculation of BPT effluent limitations for TSS, because neither of the treatment systems for the two hazardous indirect-discharging facilities included multimedia filtration to control TSS discharges, EPA used technology transfer to establish TSS limitations, using performance data from two non-hazardous facilities (16120 and 16253) that passed the TSS effluent editing criteria for the BPT effluent limitations for Non-Hazardous subcategory.

For calculation of BPT effluent limitations for ammonia, since the treatment system for only one of the two hazardous indirect-discharging facilities was considered a good performer (16041), EPA supplemented these data with performance data from two non-hazardous BPT facilities (16122 and 16132) that were considered good performers in the Non-Hazardous subcategory.

In addition, EPA applied editing criteria to the data to determine the final list of BPT facilities and sample points used to develop the BPT limits for the Hazardous subcategory. The editing criteria applied to the available data were as follows:

• EPA only used data from the two hazardous facilities selected as BPT (16041 and 16087) in the calculation of limits for toxic pollutants (except ammonia).

C EPA used technology transfer from the Non-Hazardous subcategory in establishing limits for BOD_5, TSS, and ammonia.

• EPA only used data from facilities that passed the TSS criteria in the calculation of TSS limits (16120 and 16253).

C EPA did not use effluent data from the Detailed Questionnaire (16000 series data) in the calculation of effluent limits. The pollutant data submitted in the Detailed Questionnaire contained the average concentration, the minimum and maximum concentrations, and the number of samples, whereas EPA sampling data and the Detailed Monitoring Questionnaire consisted of individual daily data. In developing limits, EPA calculated the long-term averages and variability factors using individual daily data. Furthermore, summary data (like the data submitted in the Detailed Questionnaire) may obscure the minimum detection levels used in the sampling data. The use of daily data (like the Detailed Monitoring Questionnaire and EPA sampling data) in developing limitations allows EPA to account for concentration values reported at or below the detection limits. In addition, in many cases, EPA considered reported averages from Detailed Questionnaires redundant because many facilities also reported the daily data from the Detailed Monitoring Questionnaire for the same time period in 1992 and, therefore, EPA would not have used the data in the calculation of limits. However, EPA did use, in cases where no other influent data were available, influent data from the Detailed Questionnaire to show that a landfill had treatable levels of a pollutant in the wastewater.

C EPA did not use facility data demonstrating zero or negative percent removals in the calculation of limits.

• EPA did not include data from facility 16120 in the calculation of ammonia limitations because the treatment system included air stripping.

- EPA only used effluent data if sufficient influent data were available to establish the presence of treatable levels of pollutants. The Agency only used effluent data in calculating limits if influent data for a given pollutant were available for a facility. In cases where a facility supplied effluent data for a particular pollutant but did not supply influent data in the Detailed Monitoring Questionnaire (or supplied influent data below a treatable level), EPA used the effluent data so long as influent data were available from the EPA sampling episode or the Detailed Questionnaire at a concentration above a treatable level. However, EPA did not use effluent data from EPA sampling episodes to calculate limits unless matching influent data from the EPA sampling episode are at concentrations above treatable levels.

Table 11-17 presents the hazardous BPT facilities and sample points used to calculate the hazardous BPT limitations for conventional, nonconventional, and toxic pollutants. Table 11-18 presents the hazardous BPT facilities and sample points EPA did not use to calculate the BPT limitations and the reason for their exclusion. In Table 11-19, EPA presents the final BPT limitations for the Hazardous subcategory.

Since there are no direct discharging hazardous landfills in the EPA database, EPA could not estimate pollutant reductions as a result of the regulation and the average facility costs for implementation of the regulation.

11.3 Best Conventional Pollutant Control Technology (BCT)

BCT limitations control the discharge of conventional pollutants from direct dischargers. Conventional pollutants include BOD, TSS, oil and grease, and pH. BCT is not an additional limitation, but rather replaces BAT for the control of conventional pollutants. To develop BCT limitations, EPA conducts a cost-reasonableness evaluation, which consists of a two-part cost test: 1) the POTW test and 2) the industry cost-effectiveness test.

In the POTW test, EPA calculates the cost per pound of conventional pollutants removed by industrial dischargers in upgrading from BPT to a BCT candidate technology and then compares this to the cost per pound of conventional pollutants removed in upgrading POTWs from secondary to tertiary treatment. The upgrade cost to industry, which is represented in dollars per pound of conventional pollutants removed, must be less than the POTW benchmark of $0.25 per pound (in 1976 dollars). In the industry cost-effectiveness test, the ratio of the incremental BPT to BCT cost, divided by the BPT cost for the industry, must be less than 1.29 (i.e. the cost increase must be less than 29 percent).

For the final rule, EPA established effluent limitations guidelines and standards equivalent to the BPT guidelines for the conventional pollutants covered under BPT for both subcategories. In developing BCT limits, EPA considered whether there are technologies that achieve greater removals of conventional pollutants than for BPT and whether those technologies are cost-reasonable according to the BCT cost-reasonableness evaluation. In each subcategory, EPA identified no technologies that can achieve greater removals of conventional pollutants than those promulgated for BPT that are also cost-reasonable under the BCT cost-reasonableness evaluation, and, accordingly, EPA established BCT effluent limitations equal to the BPT effluent limitations guidelines and standards.

11.4 Best Available Technology Economically Achievable (BAT)

The factors considered in establishing a BAT level of control include the following: the age of process equipment and facilities, the processes employed, process changes, the engineering aspects of applying various types of control techniques to the costs of applying the control technology, non-water quality environmental impacts such as energy requirements, air pollution and solid waste generation, and such other factors as the Administrator deems appropriate (Section 304(b)(2)(B) of the Act). In general, the BAT technology level represents the best existing economically achievable performance among facilities with shared characteristics. BAT may include process changes or internal plant controls which are not common in the industry. BAT may also be transferred from a different subcategory or industrial category.

EPA promulgated BAT effluent limitations for both landfill subcategories based upon the same technologies evaluated and selected for BPT. The BAT effluent limitations control identified toxic and nonconventional pollutants discharged from facilities. EPA did not identify any additional technologies beyond BPT that could provide additional toxic pollutant removals and that are economically achievable.

11.4.1 BAT Limits for the Subtitle D Non-Hazardous Subcategory

EPA evaluated reverse osmosis technology as a potential option for establishing BAT effluent limits more stringent than BPT for the control of toxic pollutants for the Non-Hazardous subcategory. EPA considered reverse osmosis for evaluation because of its effective control of a wide variety of toxic pollutants in addition to controlling conventional and nonconventional parameters.

EPA evaluated BAT treatment options as an increment to the baseline treatment technology used to develop BPT limits. Therefore, the BAT Option III consisted of BPT Option II (biological treatment followed by multimedia filtration) followed by a single-stage reverse osmosis unit. Figure 11-4 presents a flow diagram of the treatment system costed for BAT Option III. EPA acknowledges that reverse osmosis treatment of landfill wastewater does not require biological pretreatment. However, in evaluating potential BAT options, EPA considers the removal and costs of BAT in addition to the selected BPT option. Therefore, to analyze the incremental removals and incremental costs, EPA evaluated the reverse osmosis system after the selected BPT option (biological treatment and multimedia filtration).

EPA promulgated limits based on a BAT technology that is equivalent to the BPT technology. After an assessment of costs and pollutant reductions associated with reverse osmosis, EPA concluded that limits should not be established based on more advanced treatment technology than the BPT technology. EPA concluded that a biological system followed by multimedia filtration would remove the majority of toxic pollutants, leaving the single-stage reverse osmosis to treat the very low levels of pollutants that remained. In the Agency's analysis, BPT Option II removed 170,000 pounds of toxic pollutants per year, whereas BAT Option III removed 172,000 pounds of toxic pollutants per year. The small incremental removal of pounds of toxic pollutants achieved by BAT Option III was not justified by the large cost for the reverse osmosis treatment system. According to EPA's costing analysis, the BAT Option III, consisting of BPT Option II plus reverse osmosis, was estimated to cost the Landfills industry $130.3 million in capital costs (1998 dollars) and $45.95 million in annualized costs (pre-tax, 1998 dollars). By contrast, the selected option, BPT Option II, had capital costs of $18.87 million (1998 dollars) and annualized costs of $7.64

million (post-tax, 1998 dollars). It should be noted that reverse osmosis was much more effective than the BPT Option II at removing the often-high quantities of dissolved metals such as iron, manganese, and aluminum. However, these parameters were not included in the calculation of pound-equivalent reductions due to their use as treatment chemicals.

Table 11-20 compares the long-term averages achieved by BPT Option II, consisting of equalization, biological treatment, and multimedia filtration, to the long-term averages achieved by the reverse osmosis treatment system. For the long-term average comparison, the effluent concentrations are from the reverse osmosis treatment system sampled by EPA and described in Section 8.2.1.5, including the flow diagram in Figure 8-30. Table 11-20 shows BPT Option II achieves very low effluent concentrations that are similar to the effluent concentrations achieved by the reverse osmosis system.

Several commenters on the proposal supported EPA's decision to reject reverse osmosis as the selected technology option. While EPA rejected reverse osmosis as the basis for BAT limitations because it was very expensive and achieved very little additional removal of pollutant, other technical factors also supported this decision. EPA agrees with the commenters that there may be additional site-specific costs associated with the operation of reverse osmosis systems at landfills that it could not directly factor into its cost analysis. EPA found that it was difficult to evaluate potential operating and concentrate-disposal problems and the associated potential increase in the cost of operating a reverse osmosis system at a landfill. The fact that reverse osmosis is a technology that concentrates rather than destroys pollutants is an important consideration. These concentrates still need to be treated and disposed and, as noted by one commenter, some states may not allow them to be recycled back into the landfill. Further, recirculation may inhibit rather than stimulate anaerobic decomposition of the landfilled wastes. While the sludges generated by chemical precipitation and biological treatment require minimal treatment prior to disposal, reverse osmosis concentrates may require additional costly treatment steps prior to final disposal.

11.4.2 BAT Limits for the Subtitle C Hazardous Subcategory

As stated in the BPT analysis, EPA's survey of the hazardous landfills industry identified no in-scope respondents which were classified as direct dischargers. All of the hazardous landfills in the EPA survey were indirect or zero or alternative dischargers. Therefore, the Agency based BPT limitations on technology transfer and treatment systems in place for indirect dischargers in the Hazardous subcategory and on treatment systems in-place for BPT facilities in the Non-Hazardous subcategory. In EPA's engineering assessment of the possible BAT technology for direct-discharging hazardous facilities, EPA evaluated the same three potential technology options as those evaluated for BPT for the Hazardous landfill subcategory. These technology options were 1) aerated equalization followed by chemical precipitation with clarification and multimedia filtration, 2) aerated equalization followed by chemical precipitation with clarification, biological treatment with secondary clarification, and multimedia filtration, and 3) zero or alternative discharge, as explained above. EPA has identified no other technologies that would represent BAT level of control for this industry.

EPA determined that BAT limits should be established based on the same technology evaluated for BPT limits. As explained above at Section 11.2.3, zero or alternative discharge is not an available alternative treatment technology for this industry. Therefore, EPA promulgated BAT effluent limitations for the Hazardous landfill subcategory based upon the same treatment technology selected for BPT: equalization prior to chemical precipitation with clarification, followed by biological treatment with secondary clarification, and multimedia filtration.

11.5 New Source Performance Standards (NSPS)

New Source Performance Standards under Section 306 of the Clean Water Act represent the greatest degree of effluent reduction achievable through the application of the best available demonstrated control technology for all pollutants (i.e. conventional, nonconventional, and toxic pollutants). NSPS are applicable to new industrial direct-discharging facilities, for which construction has commenced after the publication of final regulations. Congress envisioned that new treatment systems could meet tighter controls than existing sources because of the opportunity to incorporate the most efficient processes and treatment systems into plant design. Therefore, Congress directed EPA, in establishing NSPS, to consider the best demonstrated process changes, in-plant controls, operating methods, and end-of-pipe treatment technologies that reduce pollution to the maximum extent feasible.

EPA established New Source Performance Standards (NSPS) that would control the same conventional, toxic, and nonconventional pollutants promulgated for control by the BAT effluent limitations for both subcategories. The treatment technologies used to control pollutants at existing facilities are fully applicable to new facilities. Furthermore, EPA has not identified any other technologies or combinations of technologies that are demonstrated for new sources that are different from those used to establish BPT/BCT/BAT for existing sources. Therefore, EPA established NSPS limitations that are identical to those promulgated in both subcategories for BPT/BCT/BAT.

In the proposed rule, EPA solicited comments and data on other technologies that may be appropriate for the treatment of landfill leachate from new sources. One commenter urged EPA to consider reverse osmosis as an appropriate technology for the treatment of leachate. While EPA acknowledges that reverse osmosis can treat landfill leachate to levels equivalent to, and even lower than, the final BAT limitations, EPA concluded that the reverse osmosis treatment system did not remove significantly more pounds of toxic pollutants than the treatment option selected as BAT. Therefore, EPA concluded that the large costs associated with the installation, operation, and maintenance of a reverse osmosis system would not justify the small incremental removal of pounds of toxic pollutants achieved. Therefore, EPA is promulgating NSPS limitations that are identical to those in each subcategory for BPT/BCT/BAT.

11.6 Pretreatment Standards for Existing Sources (PSES)

Section 307(b) of the Act requires EPA to promulgate pretreatment standards for pollutants that are not susceptible to treatment by POTWs or which would interfere with the operation of POTWs. After a thorough analysis of indirect-discharging landfills in the EPA database, EPA has decided not to establish

PSES for either subcategory in the Landfills Point Source Category. For the proposal, EPA proposed *not* to establish pretreatment standards for indirectly discharging landfills in the Non-Hazardous subcategory. However, for the Hazardous subcategory, EPA proposed effluent limitations and pretreatment standards for six pollutants. In response to its proposal, EPA received a number of comments supporting the decision not to propose pretreatment standards for Subtitle D landfills. In addition, a number of commenters suggested that EPA should also reconsider whether Subtitle C landfills require national categorical pretreatment standards. As a result of these comments, EPA took a second look at its data and determined that pretreatment standards were not necessary for the Landfills Point Source Category.

For both subcategories, EPA looked at a number of factors in deciding whether a pollutant was not susceptible to treatment at a POTW or would interfere with POTW operations – the predicate to establishment of pretreatment standards. First, EPA assessed the pollutant removals achieved at POTWs relative to those achieved by landfills using BAT treatment systems. Second, EPA estimated the quantity of pollutants likely to be discharged to receiving waters after POTW removals. Third, EPA studied whether any of the pollutants introduced to POTWs by landfills interfered with or were otherwise incompatible with POTW operations. EPA, in some cases, also looked at the costs and other economic impacts of pretreatment standards and the effluent reduction benefits in light of treatment systems currently in-place at POTWs. The result of EPA's evaluation showed that POTWs could adequately treat discharges of landfill pollutants. Therefore, EPA is not establishing pretreatment standards for either subcategory in this point source category.

As noted above, among the factors EPA considers before establishing pretreatment standards is whether the pollutants discharged by an industry pass through a POTW or interfere with the POTW operation or sludge disposal practices. One of the tools traditionally used by EPA in evaluating whether pollutants pass through a POTW, is a comparison of the percentage of a pollutant removed by POTWs with the percentage of the pollutant removed by discharging facilities applying BAT. In most cases, EPA has concluded that a pollutant passes through the POTW when the median percentage removed nationwide by representative POTWs (those meeting secondary treatment requirements) is less than the median percentage removed by facilities complying with BAT effluent limitations guidelines for that pollutant. For a full explanation of how EPA performs its removal analysis, see Chapter 7.

In developing the final guidelines, EPA has made a number of modifications to its calculations of pollutant removal used to compare POTW operations with BAT treatment. For example, the primary source of POTW percent removal data used for removal comparisons is an EPA document, "Fate of Priority Pollutants in Publicly Owned Treatment Works" (EPA 440/1-82/303) commonly referred to as the "50-POTW Study". The 50-POTW Study presents data on 50 well-operated POTWs with secondary treatment in removing toxic pollutants. For its removal comparison for this guideline, EPA eliminated influent values that were close to the detection limit, thereby minimizing the possibility that low POTW removals might simply reflect low influent concentrations instead of being a true measure of treatment effectiveness.

After revising the database, EPA calculated POTW-specific percent removals for each pollutant based on its average influent and average effluent values. The POTW percent removal used for each pollutant for the comparison is the median value of all the POTW-specific percent removals for that pollutant. EPA then compared the median POTW percent removal to the median percent removal for the BAT option treatment technology in order to determine pass through.

11.6.1 EPA's Decision Not to Establish PSES for the Subtitle D Non-Hazardous Subcategory

EPA estimates that there are 756 Subtitle D landfill facilities in the U.S. that discharge landfill wastewater to a POTW. The Agency did not establish pretreatment standards for existing sources (PSES) for the Non-Hazardous landfill subcategory. The Agency decided not to establish PSES for this subcategory after an assessment of the effect of landfill leachate on receiving POTWs and the cost of pretreatment standards.

EPA looked at three measures of effects on POTWs: biological inhibition levels, contamination of POTW biosolids, and a comparison of BAT and POTW removals. For the proposed rule, following procedures outlined above, the removal comparison suggested that one pollutant, ammonia, would pass through in the Non-Hazardous subcategory. However, EPA concluded that ammonia was susceptible to treatment and did not interfere with POTW operations. Therefore, the Agency did not propose to establish national pretreatment standards for ammonia.

Following the proposal, EPA reviewed the data available in the proposed Public Record for both the POTW percent removal calculations and the BAT percent removal calculations and made a number of adjustments. For the proposal, EPA calculated the BAT percent removals using data from well-operated biological treatment facilities in EPA's database. However, some of these facilities did not pass the editing criteria for selection as a BPT/BAT facility. For the revised removal comparison, EPA calculated percent removals using data from only those seven facilities that passed the BPT/BAT editing criteria. In addition, in the proposal, EPA inadvertently neglected to use selected BAT facilities in the calculation of percent removals for several pollutants even though the data for the facility passed the editing criteria.

The result of this revised comparison of removal for the Non-Hazardous subcategory suggested that BAT removal would be greater than POTW removal for four pollutants: ammonia, benzoic acid, p-cresol, and phenol. However, as explained below, EPA concluded that these pollutants do not pass through or interfere with POTW operations on a national basis and therefore has not established national categorical pretreatment regulations for these pollutants. Moreover, as discussed later in this chapter, EPA notes that adoption of PSES would result in the removal of only a small quantity of pollutants, approximately 14 toxic pound equivalents per facility per year. Such a reduction is low relative to that seen in other categorical pretreatment standards promulgated by EPA. (See 64 FR 45077).

11.6.1.1 EPA's Rationale for Not Establishing PSES for Ammonia

EPA has decided not to establish ammonia pretreatment standards for several reasons. First, while EPA's removal comparison suggests that ammonia in landfill leachate is not as amenable to POTW treatment as to pretreatment, in reality, EPA has concluded that ammonia is susceptible to POTW treatment on a national basis. Further, landfill discharges will not result in POTW upsets or interfere with POTW operations. The Public Record indicates that POTWs are not currently experiencing any difficulty in adequately treating ammonia discharges from Subtitle D landfills. No POTWs commenting on the proposal cited any persistent POTW upsets associated with landfill leachate discharges. Finally, EPA has determined that pretreatment standards for ammonia for landfill indirect dischargers would be extremely costly, given the high levels of removal currently observed. In these circumstances, EPA has concluded that ammonia is susceptible to treatment by POTWs and national pretreatment standards are not required.

Ammonia Removals

In the case of ammonia, the median BAT percent removal for the landfills industry is 99 percent compared to the median POTW percent removal which is 39 percent. (For the proposed rule, EPA calculated the POTW percent removal for ammonia to be 60 percent. However, upon applying the revised data editing procedures to the 50-POTW Study, EPA has now determined that ammonia POTW percent removal is 39 percent.) This comparison suggests that ammonia is not susceptible to treatment at a POTW and passes through. However, as discussed below, most subtitle D landfills discharging to POTWs are discharging small quantities of leachate with an ammonia concentration comparable to that observed in raw sewage.

EPA's data show that over 75 percent of indirectly discharging landfills discharge fewer than 10 pounds of ammonia per day at a concentration similar to that observed in raw sewage. Because many POTWs are designed and operated to treat ammonia (and other pollutants) in raw sewage, a POTW will adequately control landfill discharges of ammonia so long as the ammonia loadings to a POTW did not significantly differ from that typically observed. In those circumstances, ammonia will not pass through such POTWs.

Moreover, some POTWs have installed additional treatment to control ammonia. The data on POTW removal used for EPA's comparison does not reflect this fact. POTWs that have installed additional ammonia treatment (or modified existing treatment) typically achieve removals in excess of 95 percent -- much higher than the 39 percent removal observed for the POTWs in the comparison analysis. Thus, ammonia does not pass through POTWs with nitrification even in cases where significant loadings of ammonia are discharged to a POTW.

In these circumstances, EPA has concluded ammonia at levels discharged by landfills is generally susceptible to POTW treatment. Therefore, EPA concluded that ammonia limits are best established by local POTWs based on site-specific conditions in accordance with the POTW's design treatment capacity and existing mass loadings.

Upset and Interference

EPA also assessed the ammonia concentrations and loads received by POTWs from Subtitle D leachate discharges to evaluate potential upsets or interference with POTW treatment systems. EPA concluded that national pretreatment standards were not required to prevent interference with POTW operations.

In terms of landfill leachate ammonia concentrations discharged to POTWs, only one of the Subtitle D landfill facilities in EPA's database is currently discharging (i.e. after treatment, if treatment is in place) wastewater to a POTW which contains more than 105 mg/L of ammonia. The remainder of the indirect-discharging Subtitle D landfills discharged an average concentration of 37 mg/L of ammonia to POTWs, with one-half of the facilities discharging less than 32 mg/L. Typical ammonia concentrations in raw domestic sewage range from 12 to 50 mg/L ("Operation of Municipal Wastewater Treatment Plants: Manual of Practice, Volume II," Water Pollution Control Federation).

The one facility in EPA's database that was discharging more than 105 mg/L of ammonia to a POTW was discharging 1,018 mg/L of ammonia to a 114 MGD POTW which currently has ammonia control (nitrification) in place. EPA also received influent ammonia data from several POTWs that commented on the proposed rule. The average ammonia influent concentration to POTWs ranged from 14 mg/L to 35 mg/L with an average concentration of 17 mg/L. Therefore, with the exception of the one outlier, the average concentration of ammonia in leachate discharged to POTWs (37 mg/L) noted in EPA's data closely parallels POTW experience (35 mg/L). However, it should be noted that the upper ranges of leachate concentrations were higher than the upper ranges observed in domestic sewage. Nevertheless, in most instances, observed ammonia discharge levels to POTWs fall within a POTW's treatment capabilities. Thus, EPA determined that the vast majority of Subtitle D landfills are discharging ammonia to POTWs at levels comparable to that which POTWs in the ordinary course of operations receive and treat in raw domestic sewage.

No POTWs commenting on the proposal cited any specific incidents where POTW acceptance of landfill leachate containing high levels of ammonia caused persistent upsets at the POTW.   The data are consistent with that supplied by commenters and further supported EPA's understanding prior to the proposal of no documented persistent problems at POTWs due to ammonia concentrations in landfill leachate.

EPA also analyzed the effects that ammonia concentrations found in landfill leachate can have on the biological treatment systems at POTWs. In this analysis, EPA compared the concentrations of ammonia found in leachate with the activated sludge biological minimum threshold toxicity value (or inhibition value). With respect to ammonia, the inhibition value for activated sludge systems is 480 mg/L (Guidance Manual on the Development and Implementation of Local Discharge Limitations Under the Pretreatment Program, Volume 1. EPA, November 1987).   The average raw wastewater concentration of ammonia found in Subtitle D landfills in EPA's database was 199 mg/L for direct, indirect and zero dischargers. In addition, all of the average and median ammonia concentration values observed in the data submitted to EPA in comments were below the activated sludge inhibition value. EPA has consequently determined that ammonia does not represent a threat to biological treatment systems that would require establishment of pretreatment standards.

Effect on Receiving Streams

Subsequent to the proposal, EPA evaluated total wastewater flows and loads of ammonia to receiving streams associated with non-hazardous landfill indirect dischargers (an estimated 756 facilities). EPA estimated that the non-hazardous landfill industry discharges 2.7 million pounds per year of ammonia to POTWs, which results in 1.6 million pounds per year being discharged to receiving streams, assuming that the POTWs have secondary treatment achieving 39 percent removal but do not have additional treatment for ammonia control. However, as mentioned above, EPA is aware that many POTWs have installed additional treatment specifically for the control of ammonia and typically achieve removals in excess of 95 percent. A review of EPA's 1996 Clean Water Needs Survey and its Permit Compliance System database indicates that approximately 20 percent of the POTWs in the U.S. employ some sort of ammonia control. Over 75 percent of the Subtitle D landfills in EPA's database discharge less than 10 pounds per day to the POTW (3,500 pounds/year), which results in discharging less than six pounds per day (2,100 pounds/year) to receiving streams, again assuming secondary treatment only and no additional POTW ammonia controls. In light of existing ammonia control in place at POTWs, actual discharges to receiving streams are likely to be even smaller.

Cost of Pretreatment Standards

EPA has evaluated the economic costs of ammonia pretreatment standards. EPA's economic assessment of these options demonstrated very high removal costs with low associated pollutant removals. Given the high cost, EPA concluded that it is not appropriate to establish national pretreatment standards to address the limited circumstances in which POTW removal might not match BAT removal performance.

EPA evaluated the costs of pretreatment standards in terms of the toxic pound equivalents. Pound-equivalents is a term used to describe a pound of pollutant weighted by its toxicity relative to copper. These weights are known as toxic weighting factors. The Agency calculates pound-equivalents by multiplying the pounds of a pollutant discharged from a landfill by the toxic weighting factor for that pollutant. The use of pounds-equivalent reflects the fact that some pollutants are more toxic than others.

The first treatment option that EPA evaluated is biological treatment. EPA evaluated PSES Option I equivalent to BPT/BAT Option I, which was equalization plus biological treatment. This option had a total annualized cost of $34.6 million (1998 dollars). Biological treatment removed 10,650 pound-equivalents annually, or an average of 14 pound equivalents per facility per year. This represents a cost of removal of $1,900/lb-equivalents (1981 dollars) and represents the cost of removing all of the pound-equivalents removed, not just ammonia. If EPA took credit only for the pound-equivalents of ammonia removed, the annual removal cost for this option is $7,100/lb-equivalents (1981 dollars). Moreover, these calculations are based on the assumption that POTWs will only remove 39 percent of the ammonia discharged to it. If POTWs remove more ammonia than that assumed, then the cost of each pound of pollutant removed by the industrial user raises. Given the installation of additional ammonia controls at many POTWs, actual ammonia removal by POTWs will be greater than assumed.

The second technology option EPA evaluated for the control of ammonia is ammonia stripping with appropriate air pollution controls. However, according to EPA's survey of the landfills industry, only two percent of survey respondents use this technology for the treatment of landfill leachate. In addition, air or steam stripping is more commonly used for treatment of wastewater containing concentrations of ammonia that are several orders of magnitude greater than those typically found in landfill wastewater. Therefore, EPA concluded that biological treatment systems are more appropriate for the treatment of the ammonia concentrations found in landfill leachate. In addition, air stripping for ammonia removal generally requires warm climates, and therefore this may not be a viable treatment option for all landfills located in the United States. In these circumstances, effluent levels associated with air stripping may not be attainable in all cases and thus not broadly available in the landfill industry. In addition, the air stripping option for the treatment of ammonia has an estimated annualized cost of $15.1 million (1998 dollars, pre-tax costs). The cost-effectiveness for this option is also high, $4,400/lb-equivalents (1981 dollars).

As explained above, EPA concluded that the vast majority of POTWs experience no difficulty in treating the ammonia loads received from landfill indirect dischargers, and that as a result, there is generally no pass through of ammonia from landfill leachate on a national basis. Moreover, the cost of pretreatment is not warranted by the limited circumstances where pretreatment would result in reduced ammonia to surface water. But there are POTWs without additional controls for ammonia that may not be equipped to handle landfill leachate ammonia discharges. Consequently, in the proposal, EPA requested comments on requiring ammonia pretreatment standards for those landfills discharging to POTWs that do not have ammonia controls in place. Several commenters supported no pretreatment standard because of their conclusion that ammonia loads from landfills made up an insignificant amount of the total ammonia loads discharged to POTWs. Others favored pretreatment standards because of smaller POTWs that do not employ nutrient removal systems. EPA, however, is not convinced that national ammonia pretreatment standards are warranted even where landfills are discharging to POTWs without ammonia controls given the high cost of pretreatment and current ammonia concentrations in landfill leachate discharged to POTWs that are generally consistent with values observed in raw sewage. Special ammonia situations are best addressed by the local POTW based on site-specific conditions in accordance with the POTW's design treatment capacity and existing mass loadings.

All of these factors discussed above confirm EPA's decision not to establish national ammonia pretreatment standards. EPA has concluded that landfills typically discharge wastewater to POTWs containing ammonia concentrations that can be adequately treated by POTWs. Further, in cases where ammonia loading rates are at levels which may be of concern or where ammonia discharges are a water quality concern, POTWs retain the ability to establish local limits on ammonia.

11.6.1.2 EPA's Rationale for Not Establishing PSES for Benzoic Acid

Benzoic Acid Pass-Through Analysis

As stated above, for the proposal, benzoic acid was not one of the pollutants EPA determined would pass through. However, after the proposal, EPA reviewed the BAT facilities and the representative POTW facilities used for the removal comparison and determined that it had not used the appropriate editing rules. As a result of these revisions, the comparison showed that the median percent removal for benzoic acid at the landfills BAT facilities was 99 percent compared to the median POTW percent removal which was determined to be 81 percent. Because the 50-POTW database does not contain information on the percent removal of benzoic acid, EPA used the National Risk Management Research Laboratory Treatability database to estimate the percent removal. (For more information on EPA's use of the NRMRL database, see Chapter 7.)

Despite the difference in the BAT and POTW percent removals, further analysis of the data showed that both systems were achieving the same level of treatment of benzoic acid. That is, both the NRMRL database facilities representing POTWs and the landfills BAT facilities were treating benzoic acid down to non-detect levels (50 ug/L). Therefore, the smaller percent removal achieved by facilities in the NRMRL database (used to represent the POTW percent removal) is a function of lower influent concentrations at those facilities and is not necessarily indicative of inferior treatment at POTWs. EPA concluded that benzoic acid in these circumstances is susceptible to treatment at the POTW and does not pass through.

Benzoic Acid Loads Discharged to POTWs

In addition, EPA also evaluated the total flows and loads of benzoic acid discharged from non-hazardous landfills to POTWs. EPA compared the current discharge loads to the loads that would be anticipated after the implementation of pretreatment standards. As was explained above, EPA selected Option I (biological treatment) as the appropriate treatment technology and has analyzed the costs and benefits of pretreatment standards for the Non-Hazardous subcategory for this option. According to EPA's estimates, non-hazardous landfills currently discharge approximately 4,700 pounds of benzoic acid to POTWs per year resulting in an annual discharge of 900 pounds to receiving streams. PSES Option I (biological treatment) would reduce this annual discharge to receiving streams to 400 pounds per year. The average non-hazardous facility discharges only 6.4 pounds of benzoic acid annually (less than 0.02 pounds per day), and the median discharge is only 1.9 pounds per year. Furthermore, benzoic acid has a toxic weighting factor of only 0.0003. Therefore, for the entire indirect-discharging non-hazardous landfills population (approximately 756 facilities), Option I would only remove an additional 0.16 pound-equivalents per year.

As a result of the above analysis, EPA determined that national pretreatment standards for benzoic acid are not necessary because benzoic acid is susceptible to treatment by POTWs. POTWs and landfill BAT facilities both treat benzoic acid down to non-detect levels. In addition, EPA determined that the pounds of benzoic acid currently being discharged by landfills are compatible with POTW treatment and that pretreatment standards would result in little further reduction of benzoic acid.

11.6.1.3 EPA's Rationale for Not Establishing PSES for P-Cresol

P-Cresol Pass-Through Analysis

Like benzoic acid, p-cresol also did not pass through POTWs according to EPA's pass-through analysis at proposal. However, the result of its revised removal comparison showed some difference in removal. The landfills median BAT percent removal for p-cresol is 99 percent, while the estimated median POTW percent removal is 68 percent. (Again, because the 50-POTW database does not contain percent removal data for p-cresol, EPA used the NRMRL database to determine POTW removal.)

P-Cresol Concentrations and Loads Discharged to POTWs

EPA also analyzed the flows and loads of p-cresol being discharged from non-hazardous landfills to POTWs. According to EPA's estimates, non-hazardous landfills currently discharge approximately 2,730 pounds of p-cresol to POTWs per year resulting in an annual discharge of 870 pounds to receiving streams. PSES Option I (biological treatment) would reduce this discharge to receiving streams to 130 pounds/year. Furthermore, p-cresol has a toxic weighting factor of only 0.0024. Therefore, the implementation of Option I results in an additional reduction of only 3.0 pound-equivalents per year across the entire Subtitle D indirect discharge population. On average, non-hazardous landfill facilities discharge only 3.4 pounds of p-cresol annually (or 0.01 pounds per day), and the median discharge load is only 0.7 pounds per year.

Based on the data shown above, EPA concluded that the implementation of pretreatment standards for p-cresol would result in only minimal reductions in the pounds of p-cresol discharged to surface waters. In addition, p-cresol is found in non-hazardous landfill leachate at concentrations which will not cause upsets at POTWs nor should POTWs have difficulty effectively treating such concentrations. The median raw wastewater concentration for p-cresol at municipal landfills is 75 ug/L. This concentration is well below the Universal Treatment Standard (UTS) of 770 ug/L established for F039 wastes (multi-source leachate) in 40 CFR 268.48. (EPA bases UTS on the Best Demonstrated Available Treatment Technology (BDAT) for each listed hazardous waste. BDAT represents the treatment technology that EPA concludes is the most effective for treating a particular waste that is also readily available to generators and treaters.)

11.6.1.4 EPA's Rationale for Not Establishing PSES for Phenol

Although phenol appeared to pass through, EPA decided not to establish pretreatment standards for phenol based on the fact that phenol is highly biodegradable and is treated by POTWs to the same degree as the landfill direct dischargers. Furthermore, the Agency concluded that the differences in influent concentrations caused the apparent difference in removal performance between landfill direct dischargers and POTWs. As a result, the performance across the landfills direct dischargers showed higher removals than the performance at the POTWs.

In EPA's landfills database, raw wastewater concentrations of phenol at the BAT facilities in the Non-Hazardous subcategory were much higher than the influent concentrations at the POTWs used in the determination of the POTW percent removal. The average influent concentrations for phenol for the three non-hazardous BAT facilities used in the pass-through analysis ranged from 350 ug/L to 5,120 ug/L. All three of the facilities treated phenol down to the analytical minimum level (10 ug/L), corresponding to a median percent removal of 97.5 percent. For POTW performance, EPA used a total of eight POTWs in the analysis for POTW percent removal of phenol. The average influent concentration for phenol at these eight POTWs was 387 ug/L, and six of the eight effluent values were below the analytical minimum level and therefore assigned values of 10 ug/L. Thus, the average percent removal for the POTWs was 95.3 percent.

In this case, EPA concluded that the differences in removals for POTWs (95.3 percent) and BAT facilities (97.5 percent) is an artifact of the differing influent concentrations and does not necessarily reflect a real difference in treatment performance. Therefore, EPA concluded that phenol is treated to essentially the same level by direct dischargers and POTWs and, therefore, does not pass through.

Based on the pollutant loadings rationale described above for ammonia , benzoic acid, and p-cresol, and based on the highly biodegradable nature of phenol, EPA decided not to set pretreatment standards for landfills in the Non-Hazardous subcategory. In addition, the Agency concluded that in the case of discharges from Subtitle D landfills, problems that may result from elevated ammonia loads in landfill leachate are best addressed at the local level. Furthermore, the Agency has determined that as a result of the ability of POTWs to adequately treat the small quantities of benzoic acid and p-cresol being discharged from landfills, a pretreatment standard for these two pollutants is also unnecessary. EPA also concluded that the cost to implement pretreatment standards for this subcategory is not warranted by the environmental benefits associated with any small additional removals.

11.6.1.5 Public Comments to the Proposed Rule Regarding Non-Hazardous PSES

In support of EPA's proposal not to establish PSES for the Non-Hazardous subcategory, EPA received comments and data following the proposal concerning the treatment of non-hazardous landfill leachate at POTWs. A total of seventeen commenters, representing municipalities, POTWs, privately-owned landfills, trade associations, and engineering consulting firms, stated that in their experience, no POTW upsets or adverse impacts on sludge quality had occurred as a result of a POTW accepting non-hazardous landfill leachate. Several of these commenters supported their claim with data or anecdotal evidence from over 20 landfills discharging leachate to POTWs. Most of these commenters felt that local limits are currently addressing discharges from non-hazardous landfills and that any particular pollutant that may be of concern should be dealt with on a case-by-case basis. Commenters also stated that the implementation of pretreatment standards would be extremely costly for very little improvement in water quality. Commenters stressed that any mandatory pretreatment that did not take into account the ability of receiving POTWs to handle the wastewater would inevitably result in unnecessary pretreatment of some waste streams. EPA found that this comment is particularly applicable to ammonia because of the varying degrees of treatment that can be achieved by POTWs. Furthermore, several commenters felt that the constituents found in landfill leachate are similar to those found in the influent to POTWs and that the flow contribution from landfills is relatively small.

There were also several commenters who supported the establishment of pretreatment standards for non-hazardous landfill leachate. One municipality was concerned with the effects that landfill leachate can have on small community POTWs with low flows. Specifically, the commenter was concerned with elevated levels of three specific pollutants (zinc, chromium, and cyanide) at three landfills that discharge to the city's POTW. The concentrations cited by the commenter for chromium and zinc were much higher than the median concentration determined for these metals by EPA's data gathering efforts. In addition, EPA did not detect cyanide in its analytical sampling at Subtitle D landfills. As a result, EPA determined that the pollutant concentrations identified by this municipality are not indicative of the concentrations typically present at Subtitle D landfills. Therefore, in cases where elevated levels of pollutants present in landfill leachate may cause problems for a POTW, local, site-specific limits are the best way to implement controls on such discharges. Furthermore, EPA did not receive any comments from POTWs that had experienced persistent upsets as a result of accepting landfill leachate.

One other municipality felt that EPA should set pretreatment standards for non-hazardous landfills since close to 70 percent of the wastewater flow discharged from Subtitle D landfills is discharged to POTWs. EPA establishes pretreatment standards for pollutants that are not susceptible to treatment by POTWs to prevent pass through and interference based on the ability of POTWs to achieve treatment equivalent to that of direct dischargers. The percentage of total flow of an industry being discharged to POTWs is not a basis for establishing pretreatment standards. Furthermore, EPA determined that the total loads of the pollutants that are discharged to POTWs made up only a very small fraction of what the POTW receives, and that the concentrations of these pollutants are at levels that are compatible with POTW treatment.

Other commenters disagreed with EPA's statements that non-hazardous leachate is of the same quality as the headwaters of a POTW. Three of these commenters were particularly concerned with ammonia concentrations in landfill leachate (the data from these commenters was discussed in the ammonia discussion above). EPA reviewed the data submitted by these commenters and, although some pollutants exceeded EPA's median concentrations, the commenters did not cite any specific instances where the reported leachate concentrations created a problem for a receiving POTW. EPA acknowledges that elevated levels of pollutants can exist in landfill wastewater. However, the median concentrations of pollutants determined by EPA's sampling program indicate that, on a national basis, concentration levels of pollutants are not at a level to be of concern to POTWs. In addition, in many cases, the loads of pollutants discharged from landfills to POTWs make up a very small portion of the total pollutant loads received by the POTW.

Another commenter suggested that EPA consider setting pretreatment standards for sulfates and sodium in landfill discharges. The commenter stated that the levels of sodium found in landfill leachate is generally greater than the level of 20 mg/L indicated in EPA's Drinking Water Contaminant Candidate List. EPA did not include limits for sulfates or sodium since these can be found in naturally occurring compounds in landfill soils and are often constituents in treatment chemicals commonly used for wastewater treatment.

One municipality commented in favor of PSES for ammonia since its regional POTWs had to establish a local ammonia pretreatment limit of 100 mg/L to protect water quality in ocean outfalls. However, in this case, the local authority has determined that a 100 mg/L pretreatment standard is adequate for the protection of water quality in the ocean outfalls. EPA acknowledges that there may be circumstances in which POTWs may have to establish local limits in order to prevent upsets or pass through. These situations do not undercut EPA's decision not to establish national pretreatment standards for ammonia. As explained in Section 11.6.1.1, the removal technologies evaluated for PSES would result in very low ammonia discharge levels, much lower than that established by the commenter (100 mg/L). This situation further supports EPA's conclusion that local limits for ammonia provide the most appropriate control and that national pretreatment requirements for ammonia may result in unnecessary pretreatment of some waste streams. In fact, one of the two landfills discharging leachate to the district's POTW has since installed an SBR. As a result, the leachate ammonia concentration for this landfill has dropped from an average of 393 mg/L to 52 mg/L. The fact that one of the landfills has installed pretreatment to lower ammonia discharges is a good example that existing pretreatment programs are effective at requiring landfills to control their discharges.

One of the commenters in support of PSES already employs biological pretreatment at its landfill. This landfill specifically stated that concentrations of ammonia as nitrogen and total toxic organics should undergo pretreatment prior to discharge to a POTW unless the leachate is a very small constituent of the total flow of the POTW. The raw wastewater ammonia concentrations at this landfill were consistent with the median determined by EPA's sampling efforts and the facility employed biological treatment to achieve an effluent ammonia concentration that was acceptable to the local POTW. In addition, the concentrations of toxic organics found in EPA's sampling of Subtitle D landfill leachate were typically not at levels that would cause inhibition to biological treatment at a POTW. The specific organic pollutants that EPA determined to pass through were found in very low concentrations, resulting in minimal loadings discharged to POTWs. The fact that this landfill already employs pretreatment is a good example that existing pretreatment programs are effective at requiring landfills to control their discharges.

11.6.2 EPA's Decision Not to Establish PSES for the Subtitle C Hazardous Subcategory

In the proposed rule, EPA proposed pretreatment standards for six pollutants that EPA determined to pass through in the Hazardous subcategory. However, after reviewing the comments received and re-evaluating the pollutant loads in the Hazardous subcategory, EPA has decided not to establish national pretreatment standards for Subtitle C landfills.

As previously explained, EPA establishes pretreatment standards for pollutants that are not susceptible to treatment at a POTW or for pollutants that may interfere with POTW operations. As explained at section 11.2.3, for the Hazardous subcategory, EPA identified only three Subtitle C landfills, all of them indirect dischargers. EPA used data from these hazardous landfills to develop the BPT/BAT limitations for toxic pollutants because these landfills were using the treatment systems for their leachate that EPA determined was the BPT/BAT treatment technology.

EPA also performed an analysis for this subcategory in order to compare POTW removals with BAT treatment systems. As was the case for the Non-Hazardous subcategory, EPA revised the pass-through analysis data editing procedures after the proposal and as a result EPA's removal results have changed. The result of the revised comparison show BAT removals greater than POTW removals for the following eight pollutants: ammonia, alpha terpineol, aniline, benzoic acid, naphthalene, p-cresol, phenol, and pyridine.

For its removal comparison for ammonia, EPA compared the nation-wide median percentage of ammonia removed by well-operated POTWs to the percentage of ammonia removed by BAT treatment systems from both the Hazardous and Non-Hazardous subcategories. (For the reasons explained in section 11.2.4, in the case of ammonia, EPA supplemented the Hazardous subcategory data with data from non-hazardous landfill facilities.) For all other toxic pollutants, in determining whether a pollutant would pass through a POTW, the Agency compared the nation-wide median percentage of a pollutant removed by well-operated POTWs with secondary treatment to the percentage of a pollutant removed by BAT treatment systems from only the Hazardous subcategory. For the proposal, EPA proposed pretreatment standards that were equivalent to the BPT/BAT limitations for the pollutants that passed through. EPA has reconsidered its decision that it should promulgate national pretreatment standards for hazardous landfills. The reasons for this decision are explained in more detail below.

Two of the indirect discharging landfills have treatment technology in place that EPA considers to be BAT, and currently discharge very low concentrations of pollutants to their local POTWs. The third and only other indirectly discharging Subtitle C landfill for which EPA has data discharged less than 1,000 gal/day of landfill gas collection condensate to a POTW. In addition to the low wastewater flow at this landfill, the facility has relatively low raw wastewater pollutant concentrations and employs neutralization with ammonia followed by settling prior to discharge to the POTW.

Several commenters on the proposal questioned EPA's rationale for developing ammonia pretreatment standards for the Hazardous subcategory while not establishing ammonia pretreatment standards for the Non-Hazardous subcategory. EPA's database indicate that the median raw wastewater ammonia concentration for hazardous landfills is 268 mg/L as compared to the raw wastewater ammonia concentration for Subtitle D landfills which is 199 mg/L.[1] EPA has current information on ammonia concentration in wastewater discharges for two of the three Subtitle C landfills in EPA's database. One of the landfills employs biological treatment and discharges an average of 4.9 mg/L of ammonia to the POTW. The other landfill employs chemical precipitation prior to biological treatment and discharges ammonia at an average concentration of 156 mg/L. This discharge level presents no apparent problem to the receiving POTW. According to discussions with this facility and the POTW, the POTW has not set local pretreatment standards for ammonia for this landfill, and the POTW does not perform nitrification nor is there an ammonia limit in the POTW's NPDES permit. Since 1995, the POTW has seen the ammonia concentration at its headworks increase from 13 mg/L to 20 mg/L and has experienced some upsets at the POTW. However, the POTW explained that it was unsure whether the upsets are a result of the increased ammonia concentrations or due to some other constituent in the wastewater. In addition, the POTW is not sure if the landfill leachate discharge is contributing at all to the upsets. As was the case in the Non-Hazardous subcategory, EPA concluded that national pretreatment standards for ammonia are not warranted by the small quantity of ammonia being discharged to POTWs from landfills in this subcategory and due to the site-specific water quality and POTW nitrification issues associated with ammonia.

Although the removal comparison suggests that phenol may pass through, EPA decided not to establish pretreatment standards for it because it is highly biodegradable and is, in fact, treated by POTWs to the same degree as the landfill direct dischargers. The Agency concluded that any apparent difference in

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1 In the comments received on the proposal, some commenters referred to the Hazardous subcategory median ammonia raw wastewater concentration referred to in Table 6-8 on page 6-44 of the Proposed Landfills Development Document (EPA -821-R-97-022). This table lists the median ammonia raw wastewater concentration of 8.6 mg/L. However, this median concentration included numerous CERCLA facilities with discharges that consisted primarily of ground water. After proposal, EPA recalculated the median ammonia raw wastewater concentration for the Hazardous subcategory using only data from Subtitle C landfills in EPA's database. This results in a median raw wastewater ammonia concentration of 268 mg/L.

removals in the removal comparison is an artifact of differing influent concentrations rather than any difference in performance between landfill direct dischargers and POTWs.

In EPA's landfills database, raw wastewater concentrations of phenol at the two BAT facilities in the Hazardous subcategory were much higher than the influent concentrations at the POTWs used in the determination of the POTW percent removal. The average influent concentrations for phenol for the two hazardous BAT facilities used in the pass-through analysis ranged from 5,120 ug/L to 98,500 ug/L, and the average effluent concentrations ranged from 10 ug/L to 814 ug/L corresponding to an average percent removal of 99.8 percent. For POTW performance, EPA used a total of eight POTWs in the analysis for POTW percent removal of phenol. The average influent concentration for phenol at these eight POTWs was 387 ug/L, and six of the eight effluent values were below the analytical minimum level and therefore assigned values of 10 ug/L. Thus, the average percent removal for the POTWs was 95.3 percent, and therefore EPA determined that the pollutant passed through. In this case, EPA concluded that the pass-through determination is an artifact of the differing influent concentrations and does not necessarily reflect a real difference in removals. Therefore, EPA concluded that phenol is treated to essentially the same level by direct dischargers and POTWs and, therefore, does not pass through.

Further review of the comparison for alpha terpineol, aniline, benzoic acid, naphthalene, and pyridine under the revised analysis showed that all of these pollutants were treated down to non-detect levels in both the landfill's BAT treatment option and in the NRMRL facilities representing POTWs. That is, both BAT facilities and POTWs achieve the same level of treatment for these pollutants, and the differences in removal once again were simply a function of smaller influent concentrations at facilities representing POTWs. (Alpha terpineol and benzoic acid are compounds for which a high removal efficiency would be expected at a POTW due to their relatively high biodegradability.) Therefore, the Agency determined that, not only are the current pollutant loads not a problem for POTWs, but also all of these pollutants are present in concentrations that are treated down to non-detect levels in a well-operated POTW. Thus, given the small loadings and low concentrations of these pollutants, EPA concluded that these five pollutants are susceptible to treatment at the POTW and do not pass through.

Furthermore, EPA has concluded that while the removal comparison suggests that two pollutants, naphthalene and aniline, may not be susceptible to POTW treatment, in fact, they will receive equivalent treatment. First, the median untreated wastewater concentration observed in EPA's data collection effort for these pollutants is less than the Universal Treatment Standards (UTS) EPA has developed for these pollutants in F039 wastes (multi-source leachate) in 40 CFR 268.48. The UTS for naphthalene is 0.059 mg/L which is slightly greater than the median concentration found in hazardous landfills (0.049 mg/L). The UTS standard for aniline is 0.81 mg/L while the median concentration in hazardous landfills is 0.237 mg/L. Second, aniline and naphthalene (as well as p-cresol and pyridine) will be removed from wastewater through attachment to the biosolids in the POTW's biological treatment system and then undergo subsequent biodegradation while entrained in the biosolids.

In addition, as noted above, the revised comparison shows a lower POTW removal for p-cresol than that achieved by BAT treatment. However, as was the case in the Non-Hazardous subcategory, EPA has concluded that the concentrations of p-cresol and the associated loadings discharged to POTWs from landfills in the Hazardous subcategory would be insignificant compared to the total loads received at the POTW. The median Subtitle C raw wastewater concentration for p-cresol is 144 ug/L (this includes only Subtitle C landfills and not the CERCLA data included in the median on page 6-44 of the Proposed Landfills Development Document) which is less than the UTS developed for p-cresol in F039 wastes which is 770 ug/L (40 CFR 268.48).

Therefore, based on the small quantity of pollutants involved and low pollutant concentrations discharged from landfills in the Hazardous subcategory, EPA concluded that national pretreatment standards for landfills in the Hazardous subcategory are unnecessary. In addition, EPA concluded that local limits are adequately controlling wastewater discharges from Subtitle C landfills.

11.7 Pretreatment Standards for New Sources (PSNS)

Section 307 of the Clean Water Act requires EPA to promulgate both pretreatment standards for new sources and new source performance standards. New indirect-discharging facilities, like new direct-discharging facilities, have the opportunity to incorporate the best available demonstrated technologies, including process changes, in-facility controls, and end-of-pipe treatment technologies.

EPA decided not to establish pretreatment standards for new sources for both subcategories for many of the same reasons that EPA did not establish PSES limits. As stated in the PSES discussions above, EPA concluded that the typical concentrations of pollutants in landfill leachate are not at levels that will cause problems for POTWs. In addition, EPA determined that the relatively small wastewater flows from landfills, coupled with the concentrations of pollutants typically found, result in small pollutant loading rates discharged to POTWs from landfills. Finally, in site-specific cases where a particular pollutant may be found at concentrations that are of concern to the POTW, EPA concluded that local pretreatment standards are the most appropriate means for controlling such discharges.

Table 11-1: Removal of Pollutant of Interest Metals in the Non-Hazardous Subcategory (ug/L)

Non-Hazardous POI Metals	CAS #	Landfills Raw Wastewater Data		NRMRL Treatability Data (1)		Published Inhibition Levels (2)	50-POTW Study (3)			OCPSF 12 Plant Sampling Data (4)	
				Biological Treatment Systems						Biological Treatment Systems	
		Subtitle D Municipal Median Concentration	Subtitle D Non-Municipal Median Concentration	Influent Concentration	Percent Removal		Maximum Influent Concentration	Mean Influent Concentration	Median Percent Removal	Median Influent Concentration	Percent Removal
Barium	7440393	483	822	1,000-10,000	84.0	NA	NA	NA	NA	NA	NA
Chromium	7440473	28	NA	44	45.0	1,000-100,000	2,380	173	82	440	68.5
Strontium	7440246	1,671	4,615	1,000-10,000	14.0	NA	NA	NA	NA	NA	NA
Titanium	7440326	64	11.8	55	34.0	NA	NA	NA	NA	NA	NA
Zinc	7440666	100	93	372	56.0	80-5,000	9,250	723	79	322	58.5

NA - Not applicable or not available.
(1) Source: EPA National Risk Management Research Laboratory (NRMRL) Treatability Database.
(2) Source: EPA Guidance Manual on the Development and Implementation of Local Discharge Limitations Under the Pretreatment Program, Volume 1. EPA Nov 1987.
(3) Source: EPA Fate of Priority Pollutants in Publicly Owned Treatment Works. (EPA 440/1-82/303, September 1982).
(4) Source: EPA Organic Chemicals, Plastics and Synthetic Fibers Public Record.

Table 11-2: List of Subtitle D Municipal Solid Waste Facilities Employing Biological Treatment Considered for BPT in the Non-Hazardous Subcategory

Facility Questionnaire ID Numbers	
16001	16119
16047	16120
16048	16121
16049	16122
16052	16123
16056	16125
16058	16127
16059	16129
16060	16132
16063	16154
16065	16155
16077	16158
16078	16159
16079	16161
16083	16164
16085	16165
16088	16166
16093	16170
16097	16171
16099	16174
16102	16176
16117	16253
16118	

Table 11-3: Comparison of Raw Wastewater Mean Concentrations of Non-Hazardous Pollutants of Interest for Municipal Solid Waste Landfills and Hazardous Facility 16041

Cas No.	Pollutant	Mean concentration of Pollutants of Interest for All Municipal Landfills in EPA Database	Mean Concentration of Pollutants of Interest for Hazardous Facility 16041
C-002	Biochemical Oxygen Demand	1,228,534	877,875
C-004	Chemical Oxygen Demand	2,024,932	2,033,750
C-005	Nitrate/Nitrite	5,844	1,770
C-009	Total Suspended Solids	735,308	191,375
C-010	Total Dissolved Solids	4,195,518	12,275,000
C-012	Total Organic Carbon	661,478	562,250
C-020	Total Phenols	142,838	3,195
106445	P-Cresol	246	218
108101	4-Methyl-2-Pentanone	3,789	2,175
108883	Toluene	166	1,468
108952	Phenol	287	1,553
120365	Dichloroprop	10	2
123911	1,4-Dioxane	118	10
142621	Hexanoic Acid	13,148	1,632
18540299	Chromium (Hexavalent)	77	Not analyzed
20324338	Tripropyleneglycol Methyl Ether	568	1,750
298044	Disulfoton	9	Not analyzed
3268879	OCDD	0.03	6
35822469	1234678-HpCDD	0.002	1
65850	Benzoic Acid	7,220	5,294
67641	2-Propanone	2,407	4,398
68122	N,N-Dimethylformamide	214	Not analyzed
7440213	Silicon	30,913	5,518
7440246	Strontium	1,569	2,846
7440326	Titanium	66	65
7440393	Barium	720	Not analyzed
7440428	Boron	3,005	8,839
7440473	Chromium	46	87
7440666	Zinc	1,476	253
75092	Methylene Chloride	70	49
7664417	Ammonia Nitrogen	238,163	382,250
78933	2-Butanone	5,119	6,398
95487	O-Cresol	298	10
98555	Alpha Terpineol	334	691

Table 11-4: Candidate BPT Facilities for the Non-Hazardous Subcategory
Eliminated from BPT Consideration Because No BOD_5 Effluent Data Was Available

Facility Questionnaire ID Numbers	
16001	16102
16047	16119
16056	16121
16059	16123
16060	16154
16063	16155
16078	16158
16079	16159
16083	16166
16085	16174

Table 11-5: Treatment Systems In Place at Landfill Facilities Considered for BPT Which Supplied BOD_5 Effluent Data

Facility QID	Treatment in Place
16041	Sequencing batch reactor (SBR)
16048	Aerobic (oxidation pond)
16049	Aerobic-anaerobic (facultative pond)
16052	Aerobic-anaerobic (oxidation pond)
16058	Aerated lagoon
16065	Aerobic pond
16077	Aerated lagoon
16088	Equalization, sand filter, carbon adsorption, aerobic
16093	Activated sludge, secondary clarifier, disinfection, multimedia filtration
16097	Activated sludge, secondary clarifier
16099	Equalization, chemical precipitation, flocculation, coalescing, anaerobic, activated sludge with PACT, nitrification, secondary clarifier
16117	Equalization, chemical precipitation, primary clarifier, aerated fixed film, secondary clarifier, denitrification
16118	Equalization, chemical precipitation, primary clarifier, anaerobic, aerobic, secondary clarifier
16120	Settling, aeration, chemical precip, primary clarifier, air stripper, neutralization, activated sludge, secondary clarifier, multimedia filtration, disinfection
16122	Equalization, chemical precipitation, primary clarifier, anaerobic, aerobic, secondary clarifier, aerobic equalization, multimedia filtration
16125	Aeration, chemical precipitation, primary clarifier, SBR, secondary clarifier, carbon adsorption, multimedia filtration
16127	Unstirred tank, aeration
16129	Neutralization (lime), chemical precipitation, primary clarifier, activated sludge, secondary clarifier, sand filter, air stripping
16132	Aerated pond
16161	Aeration, aerobic, settling (aerated pond)
16164	Aeration, chemical precipitation, primary clarifier, neutralization, equalization, aerobic, secondary clarifier
16165	Aerobic, settling (aerated pond)
16170	Equalization, stabilization pond
16171	Equalization, activated sludge, settling
16176	Aeration, activated sludge, settling
16253	Equalization, chemical precipitation, primary clarifier, anaerobic, activated sludge, secondary clarifier, nitrification, multimedia filter

Table 11-6: Landfill Facilities Considered for BPT in the Non-Hazardous Subcategory which Supplied BOD_5 Effluent Data

Facility QID	Bsl Flow (MGD)	BOD5 (mg/L)								Reason Facility Data was not Considered for BOD Limitations
		Facility Avg		DET		DMQ		ANL		
		Inf	Eff	Inf	Eff	Inf	Eff	Inf	Eff	
16041	0.058917	910	47	-	-	-	-	910	45	Data used for calculating BOD limits
16048	0.000005	NA	41	-	-	-	-	-	-	No BOD influent data
16049	0.0017	NA	NA	-	4.8	-	-	-	-	No BOD influent data
16052	0.0546	NA	37	-	37	-	-	-	-	No BOD influent data
16058	0.003	153	24	-	22	-	30	153	-	Data used for calculating BOD limits
16065	0.008	NA	35	-	35	-	-	-	-	No BOD influent data
16077	0.00816	54	10	54	10	-	-	-	-	Average influent BOD concentration below 100 mg/L
16088	0.03621	3799	209	-	200	3799	223	-	-	Effluent BOD concentration greater than 50 mg/L
16093	0.081575	24	8.3	27	6	22	8.3	-	-	Average influent BOD concentration below 100 mg/L
16097	0.019	23	14	-	20	23	14.3	-	-	Average influent BOD concentration below 100 mg/L
16099	0.01533	3600	11.5	-	8	3600	11.5	-	-	Carbon treatment used in addition to biological treatment
16117	0.04	180	4.8	-	4	180	5.5	-	-	Separate treatment trains (BIO/CPR) employed before
16118	0.0288	1990	48	2200	49	1890	46	-	-	Data used for calculating BOD limits
16120	0.042775	790	10	-	16	780	4.6	1290	-	Data used for calculating BOD and TSS limits
16122	0.0255	1007	6.1	-	5.3	-	5.4	1007	30	Data used for calculating BOD and TSS limits
16125	0.014193	1673	57	1141	10	2394	-	379	171	Carbon treatment used in addition to biological treatment
16127	0.003627	NA	40	-	-	-	40	-	-	Wastewater stream consists primarily of storm water
16129	0.00469	214	1.8	-	-	214	1.8	-	-	Wastewater stream consists primarily of ground water
16132	0.03	7609	15.7	5581	7	4741	16	-	-	Data used for calculating BOD limits
16161	0.053	NA	171	-	171	-	-	-	-	No BOD influent data
16164	0.01	NA	487	-	487	-	-	-	-	No BOD influent data
16165	0.030218	1812	974	1812	974	-	-	-	-	Effluent BOD concentration greater than 50 mg/L
16170	0.0048	69	63	-	54	69	72	-	-	Average influent BOD concentration below 100 mg/L
16171	0.024	NA	213	-	213	-	-	-	-	No BOD influent data
16176	0.037272	NA	112	-	112	-	-	-	-	No BOD influent data
16253	0.01776	327	6.4	1000	5.2	159	6.4	-	-	Data used for calculating BOD and TSS limits

Bsl Flow: Baseline flow

Facility Avg: Flow weighted average calculated from all data sources available at the facility (DET, DMQ, ANL)

DET: Detailed Questionnaire data from 1992

DMQ: Detailed Monitoring Questionnaire data from 1992 through 1994

ANL: Analytical data from sampling episodes 1993-1995

NA: Not Available

Table 11-7: Selected BPT Facilities for the Non-Hazardous Subcategory

Detailed Questionnaire ID Number	Discharge Status	Treatment in Place
16041	Indirect	sequential batch reactor
16058	Direct	equalization, aerated lagoon
16118	Indirect	aerated equalization, chemical precipitation, anaerobic fixed film, aerobic fixed film, clarification
16120	Direct	aerated equalization, chemical precipitation, ammonia strip lagoons, neutralization, activated sludge, multimedia filter, chlorination
16122	Direct	aerated equalization, chemical precipitation, flocculation, clarification, neutralization, anaerobic fixed film, aerobic fixed film, neutralization, coagulation, flocculation, clarification, chlorination, aerated equalization, multimedia filter
16132	Indirect	aerated pond
16253	Direct	equalization, chemical precipitation, flocculation, clarification, neutralization, anaerobic filtration, 2-stage activated sludge, multimedia filter

Table 11-8: TSS Data from Landfill Facilities Selected for BPT in the Non-Hazardous Subcategory

Facility QID	Baseline Flow (MGD)	TSS (mg/L)							
		Facility Average		DET		DMQ		ANL	
		Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent
16041	0.058917	330	36	364	36	307	35	70	46
16058	0.003	14470	188	-	216	-	188	14470	-
16118	0.0288	NA	NA	-	-	-	-	-	-
16120	0.042775	1221	14	-	14	1241	13.6	200	-
16122	0.0255	267	5.4	-	5.6	-	5.4	267	12.5
16132	0.03	244	47	244	39	-	47	-	-
16253	0.01776	150	25	180	17.5	120	25	-	-

Facility Avg: weighted average calculated from all data sources available at the facility (DET, DMQ, ANL).

DET: Detailed Questionnaire data from 1992

DMQ: Detailed Monitoring Questionnaire data from 1992 through 1994

ANL: Analytical data from sampling episodes 1993-1995

NA: Not Available

Table 11-9: Facilities and Sample Points Used for the Development of BPT/BAT Effluent Limitations for the Non-Hazardous Subcategory

BPT Facility	Data Source	Influent Sample Point	Avg. Influent Concentration	Effluent Sample Point	Avg. Effluent Concentration
Ammonia (mg/L)					
16041	DMQ ANL	02 01, 03, 05, 06	679 475	04 02	5.4 1.4
16122	ANL	01, 02, 03	181	07	1.2
16132	DMQ	01, 02, 03	206	04	5.9
BOD_5 (mg/L)					
16041	ANL	01, 03, 05, 06	910	02	47
16058	DMQ ANL	- 01, 02	- 153	01 -	29.7 Only influent conc. used
16118	DMQ	01	1,890	02	45.5
16120	DMQ	01	780	02	4.6
16122	ANL	01, 02, 03	1,007	07	35.2
16132	DMQ	01, 02, 03	4,740	04	15.8
16253	DMQ	01	159	02	6.4
TSS (mg/L)					
16120	DMQ	01	1,240	02	13.6
16253	DMQ	01	120	02	24.9
Alpha Terpineol (ug/L)					
16041	ANL	01, 03, 05, 06	653	02	10
16122	ANL	01, 02, 03	123	07	10
Benzoic Acid (ug/L)					
16041	ANL	01, 03, 05, 06	15,400	02	50
16122	ANL	01, 02, 03	9,300	07	50
P-Cresol (ug/L)					
16041	ANL	01, 03, 05, 06	1,360	02	10

Table 11-9: Facilities and Sample Points Used for the Development of BPT/BAT Effluent Limitations for the Non-Hazardous Subcategory (continued)

BPT Facility	Data Source	Influent Sample Point	Avg. Influent Concentration	Effluent Sample Point	Avg. Effluent Concentration
Phenol (ug/L)					
16041	ANL	01, 03, 05, 06	5,120	02	10
16118	DET DMQ	01 01	350 -	02 02	Only influent conc. used 11
16120	DMQ ANL	01 01	16 712	02 -	27.7 Only influent conc. used
16122	ANL	01, 02, 03	395	07	10
Zinc (ug/L)					
16041	DMQ ANL	02 01, 03, 05, 06	505 310	04 02	214 87
16058	DMQ ANL	- 01, 02	- 995	01 -	59 Only influent conc. used
16132	DMQ	01, 02, 03	490	04	50

ANL: Analytical data
DET: Detailed Questionnaire data
DMQ: Detailed Monitoring Questionnaire data

Table 11-10: BPT Facility Data Excluded from the Calculation of Non-Hazardous BPT/BAT Limitations

BPT Facility	Influent Sample Point	Avg. Influent Conc.	Effluent Sample Point	Avg. Effluent Conc.	Reason for Exclusion
BOD_5 (mg/L)					
16041 DMQ	02 02	- -	04 04	- -	No data No data
16058	-	-	01	22	Detailed questionnaire data was not used
16118	01	2,200	02	49	Detailed questionnaire data was not used
16120 ANL	- 01	- 1,290	02 -	15.9 -	Detailed questionnaire data was not used No effluent data
16122 DMQ	01 01	- -	03 03	5.3 5.4	Effluent sample point 03 located after aerated equalization
16132	01,02,03	5,581	04	7	Detailed questionnaire data was not used
16253	01	1,000	02	5.2	Detailed questionnaire data was not used
TSS (mg/L)					
16041 DMQ ANL	02 02 1, 3, 5, 6	364 307 70	04 04 02	36 35 46	Facility wastewater treatment system does not employ filtration
16058 DMQ ANL	- - 01, 02	- - 14,470	01 01 -	216 188 -	Facility wastewater treatment system does not employ filtration
16118 DMQ	01 01	- -	02 02	- -	Facility wastewater treatment system does not employ filtration
16120 ANL	- 01	- 200	02 -	14 -	Detailed questionnaire data was not used No effluent data
16122 DMQ ANL	01 01 01,02,03	- - 267	03 03 07	5.6 5.4 12.5	Facility eliminated due to settling that can occur in equalization tanks prior to filtration
16132 DMQ	01,02,03 01,02,03	244 -	04 04	39 47	Facility wastewater treatment system does not employ filtration
16253	01	180	02	17.5	Detailed questionnaire data was not used

Table 11-10: BPT Facility Data Excluded from the Calculation of Non-Hazardous BPT/BAT Limitations (continued)

BPT Facility	Influent Sample Point	Avg. Influent Conc.	Effluent Sample Point	Avg. Effluent Conc.	Reason for Exclusion
Ammonia (mg/L)					
16041	02	554	04	5.0	Detailed questionnaire data was not used
16058	-	-	01	-	No data
DMQ	-	-	01	-	No data
ANL	01, 02	2,900	-	-	No effluent data
16118	01	-	02	-	No data
DMQ	01	-	02	-	No data
16120	-	-	02	1.35	Facility wastewater treatment system employed an air stripper
DMQ	01	362	02	5.98	
ANL	01	245	-	-	
16122	01	136	03	0.87	Effluent sample point 03 located after aerated equalization
DMQ	01	135	03	0.48	
16132	01,02,03	-	04	-	No data
16253	01	-	02	-	No data
DMQ	01	-	02	0.01	No influent data
Alpha Terpineol (ug/L)					
16041	02	-	04	-	No data
DMQ	02	-	04	-	No data
16058	-	-	01	-	No data
DMQ	-	-	01	-	No data
ANL	01, 02	-	-	-	No data
16118	01	-	02	-	No data
DMQ	01	-	02	-	No data
16120	-	-	02	-	No data
DMQ	01	-	02	-	No data
ANL	01	-	-	-	No data
16122	01	-	03	-	No data
DMQ	01	-	03	-	No data
16132	01,02,03	-	04	-	No data
DMQ	01,02,03	-	04	-	No data
16253	01	-	02	-	No data
DMQ	01	-	02	-	No data

Table 11-10: BPT Facility Data Excluded from the Calculation of Non-Hazardous BPT/BAT Limitations (continued)

BPT Facility	Influent Sample Point	Avg. Influent Conc.	Effluent Sample Point	Avg. Effluent Conc.	Reason for Exclusion
Benzoic Acid (ug/L)					
16041	02	-	04	-	No data
DMQ	02	-	04	-	No data
16058	-	-	01	-	No data
DMQ	-	-	01	50	No influent data
ANL	01, 02	50	-	-	Influent concentration < 10xMDL
16118	01	-	02	-	No data
DMQ	01	-	02	-	No data
16120	-	-	02	-	No data
DMQ	01	-	02	-	No data
ANL	01	-	-	-	No data
16122	01	-	03	-	No data
DMQ	01	-	03	-	No data
16132	01,02,03	-	04	-	No data
DMQ	01,02,03	-	04	-	No data
16253	01	-	02	-	No data
DMQ	01	-	02	20	No influent data
P-Cresol (ug/L)					
16041	02	-	04	-	No data
DMQ	02	-	04	-	No data
16058	-	-	01	-	No data
DMQ	-	-	01	10	No influent data
ANL	01, 02	48	-	-	Influent concentration < 10xMDL
16118	01	-	02	-	No data
DMQ	01	-	02	-	No data
16120	-	-	02	-	No data
DMQ	01	30	02	10	Influent concentration < 10xMDL
ANL	01	10	-	-	Influent concentration < 10xMDL
16122	01	-	03	-	No data
DMQ	01	425	03	-	No effluent data
ANL	01,02,03	10	07	10	Influent concentration < 10xMDL
16132	01,02,03	-	04	-	No data
DMQ	01,02,03	-	04	-	No data

Table 11-10: BPT Facility Data Excluded from the Calculation of Non-Hazardous BPT/BAT Limitations (continued)

BPT Facility	Influent Sample Point	Avg. Influent Conc.	Effluent Sample Point	Avg. Effluent Conc.	Reason for Exclusion
16253 DMQ	01 01	- -	02 02	- -	No data No data
Phenol (ug/L)					
16041 DMQ	02 02	- -	04 04	- -	No data No data
16058 DMQ ANL	- - 01, 02	- - 10	01 01 -	10 10 -	Detailed questionnaire data was not used No influent data Influent concentration < 10xMDL
16120	-	-	02	-	No data
16122 DMQ	01 01	3,050 -	03 03	10 -	Effluent sample point 03 located after aerated equalization
16132 DMQ	01,02,03 01,02,03	- -	04 04	- -	No data No data
16253 DMQ	01 01	- -	02 02	- -	No data No data
Zinc (ug/L)					
16041	02	1,130	04	200	Detailed questionnaire data was not used
16058	-	-	01	10	Detailed questionnaire data was not used
16118 DMQ	01 01	380 295	02 02	50 45	Facility wastewater treatment system includes chemical precipitation
16120 DMQ ANL	- 01 01	- 230 85	02 02 -	40 37 -	Facility wastewater treatment system includes chemical precipitation
16122 DMQ ANL	01 01 01,02,03	212,000 805 120	03 03 07	16 22 12	Facility wastewater treatment system includes chemical precipitation
16132	01,02,03	575	04	10	Detailed questionnaire data was not used
16253 DMQ	01 01	20 90	02 02	38 50	Facility wastewater treatment system includes chemical precipitation

ANL: Analytical data
DET: Detailed Questionnaire data
DMQ: Detailed Monitoring Questionnaire data

Table 11-11: BPT/BAT Limitations for the Non-Hazardous Subcategory

Pollutant or Pollutant Property	Maximum for 1 day (mg/L)	Monthly Average Shall Not Exceed (mg/L)
BOD_5	140	37
TSS	88	27
Ammonia	10	4.9
Alpha Terpineol	0.033	0.016
Benzoic Acid	0.12	0.071
P-Cresol	0.025	0.014
Phenol	0.026	0.015
Zinc	0.20	0.11
pH	([1])	([1])

([1]) pH shall be in the range 6.0 - 9.0 pH units.

Table 11-12: National Estimates of Pollutant of Interest Reductions for BPT/BAT Options for Municipal Solid Waste Landfills - Direct Dischargers

		National Estimates			
Pollutant of Interest CAS Number	Pollutant of Interest	Current Discharge Loads (pounds/yr)	BPT/BAT Option I Loads (pounds/yr)	BPT/BAT Option II Loads (pounds/yr)	BAT Option III -RO Loads (pounds/yr)
C-020	TOTAL PHENOLS (CHLOROFORM EXTRACTION)	1,005	166	125	125
C-012	TOTAL ORGANIC CARBON	692,275	352,957	231,875	127,805
C-010	TOTAL DISSOLVED SOLIDS	13,158,362	13,109,304	12,086,905	621,714
C-009	TOTAL SUSPENDED SOLIDS	319,754	195,173	92,491	21,328
C-005	NITRATE/NITRITE	109,494	109,494	109,494	3,527
C-004	CHEMICAL OXYGEN DEMAND	2,364,028	1,597,988	1,497,581	373,389
C-002	BIOCHEMICAL OXYGEN DEMAND	478,004	144,915	105,561	105,561
98555	ALPHA-TERPINEOL	247	53	53	53
95487	O-CRESOL	62	53	53	53
78933	2-BUTANONE	2,846	2,846	2,846	2,846
7664417	AMMONIA NITROGEN	174,382	26,279	16,978	16,978
75092	METHYLENE CHLORIDE	385	385	385	385
7440666	ZINC	857	249	249	249
7440473	CHROMIUM	110	103	103	103
7440393	BARIUM	1,449	926	926	639
7440326	TITANIUM	123	20	20	20
7440246	STRONTIUM	3,404	1,812	1,812	533
68122	N,N-DIMETHYLFORMAMIDE	69	53	53	53
67641	2-PROPANONE	1,642	1,642	1,642	1,642
65850	BENZOIC ACID	350	265	265	265
298044	DISULFOTON	22	22	22	11
20324338	TRIPROPYLENEGLYCOL METHYL ETHER	840	528	528	528
18540299	CHROMIUM (HEXAVALENT)	117	117	117	50
142621	HEXANOIC ACID	9,183	53	53	53
123911	1,4-DIOXANE	55	55	55	55
120365	DICHLOROPROP	16	6	6	5
108952	PHENOL	298	56	56	56
108883	TOLUENE	191	191	191	191
108101	4-METHYL-2-PENTANONE	228	228	228	228
106445	P-CRESOL	151	48	48	48
35822469	1234678-HPCDD	6E-04	3E-04	3E-04	3E-04
3268879	OCDD	7E-03	2E-03	1E-03	1E-03

Table 11-13: National Estimates of Pollutant of Interest Reductions for BPT/BAT Options for Non-Municipal Solid Waste Landfills - Direct Dischargers

		National Estimates			
Pollutant of Interest CAS Number	Pollutant of Interest	Current Discharge Loads (pounds/yr)	BPT/BAT Option I Loads (pounds/yr)	BPT/BAT Option II Loads (pounds/yr)	BAT Option III -RO Loads (pounds/yr)
C-002	Biochemical Oxygen Demand	24,492	24,492	24,492	24,492
C-004	Chemical Oxygen Demand	5,633,111	1,033,662	907,417	147,359
C-009	Total Suspended Solids	22,451	22,451	22,451	8,164
C-005	Nitrate/Nitrite	73,475	1,939	1,939	1,359
C-020	Total Phenols	241	78	53	53
C-012	Total Organic Carbon	55,107	55,107	55,107	51,025
C-010	Total Dissolved Solids	69,189,296	13,878,575	6,385,329	339,723
7664417	Ammonia as Nitrogen	153,074	11,062	6,994	6,994
7440246	Strontium	61,229	54,494	54,494	204

Table 11-14: Annual Pollutant Discharge Before and After the Implementation of BPT for Subtitle D Municipal Solid Waste Landfill Facilities in the Non-Hazardous Subcategory

Pollutant Group	Current Annual Pollutant Discharge (pounds)	Annual Pollutant Discharge After Implementation of BPT (pounds)	Annual Amount of Pollutants Removed by BPT (pounds)
Conventional Pollutants[(1)]	800,000	200,000	600,000
Nonconventional Pollutants[(2)]	16,500,000	13,950,000	2,550,000
Metal Pollutants[(3)]	6,000	3,200	2,800
Organic Pollutants[(4)]	16,500	6,500	10,000 [(7)]
Pesticides[(5)]	40	29	11
Dioxins/ Furans[(6)]	0.0075	0.0013	0.0062

(1) Includes BOD_5 and TSS
(2) Includes ammonia, COD, TDS, TOC, total phenols, and nitrate/nitrite
(3) Includes barium, chromium, hexavalent chromium, strontium, titanium, and zinc
(4) Includes alpha terpineol, benzoic acid, hexanoic acid, N,N-Dimethylformamide, o-cresol, p-cresol, phenol, tripropyleneglycol methyl ether, methylene chloride, 1,4 dioxane, 2-butanone, 2-propanone, 4-methyl-2-pentanone, and toluene
(5) Includes dichloroprop and disulfoton
(6) Includes OCDD and 1,2,3,4,6,7,8-HpCDD
(7) EPA did not include the removal of the following volatile organic compounds: methylene chloride, 1,4 dioxane, 2-butanone, 2-propanone, 4-methyl 2-pentanone, and toluene

Table 11-15: Annual Pollutant Discharge Before and After The Implementation of BPT for Subtitle D Non-Municipal Solid Waste Landfill Facilities in the Non-Hazardous Subcategory

Pollutant Group	Current Annual Pollutant Discharge (pounds)	Annual Pollutant Discharge After Implementation of BPT (pounds)	Annual Amount of Pollutants Removed by BPT (pounds)
Conventional Pollutants (1)	47,000	47,000	0
Nonconventional Pollutants (2)	75,100,000	7,350,000	67,750,000
Metal Pollutants (3)	61,200	54,500	6,700

(1) Includes BOD_5 and TSS. Both facilities in the database were already in compliance with the BOD_5 and TSS limits.

(2) Includes ammonia, nitrate/nitrite, TDS, TOC, total phenol, and COD.

(3) Includes strontium - the only metal pollutant of interest for non-municipal solid waste landfills.

Table 11-16: Selected BPT Facilities for the Hazardous Subcategory

Detailed Questionnaire ID Number	Discharge Status	Treatment in Place
16041	Indirect	sequential batch reactor
16087	Indirect	stirred equalization, chemical precipitation, flocculation, neutralization, clarification, activated sludge, chemical oxidation

Table 11-17: Facilities and Sample Points Used for the Development of BPT/BAT Effluent Limitations for the Hazardous Subcategory

BPT Facility	Data Source	Influent Sample Point	Avg. Influent Concentration	Effluent Sample Point	Avg. Effluent Concentration
Ammonia (mg/L)					
16041	DMQ ANL	02 01, 03, 05, 06	679 475	04 02	5.4 1.4
16122	ANL	01, 02, 03	181	07	1.2
16132	DMQ	01, 02, 03	206	04	5.9
BOD_5 (mg/L)					
16041	ANL	01, 03, 05, 06	910	02	47
16058	DMQ ANL	- 01, 02	- 153	01 -	29.7 Only influent conc. used
16087	DMQ	01	2,929	05	29
16118	DMQ	01	1,890	02	45.5
16120	DMQ	01	780	02	4.6
16122	ANL	01, 02, 03	1,007	07	35.2
16132	DMQ	01, 02, 03	4,740	04	15.8
16253	DMQ	01	159	02	6.4
TSS (mg/L)					
16120	DMQ	01	1,240	02	13.6
16253	DMQ	01	120	02	24.9
Alpha Terpineol (ug/L)					
16041	ANL	01, 03, 05, 06	653	02	10
Aniline (ug/L)					
16041	ANL	01, 03, 05, 06	1,060	02	10
16087	ANL	01	533	03	10
Benzoic Acid (ug/L)					
16041	ANL	01, 03, 05, 06	15,400	02	50
16087	ANL	01	64,957	03	50

Table 11-17: Facilities and Sample Points Used for the Development of BPT/BAT Effluent Limitations for the Hazardous Subcategory (continued)

Pollutant	BPT Facility	Influent Sample Point	Avg. Influent Concentration	Effluent Sample Point	Avg. Effluent Concentration
Naphthalene (ug/L)					
16041	ANL	01, 03, 05, 06	645	02	10
P-Cresol (ug/L)					
16041	ANL	01, 03, 05, 06	1,360	02	10
16087	ANL	01	5,022	03	10
Phenol (ug/L)					
16041	ANL	01, 03, 05, 06	5,120	02	10
16087	ANL	01	65,417	03	29.7
Pyridine (ug/L)					
16087	ANL	01	301	03	10
Arsenic (ug/L)					
16087	DMQ ANL	01 01	1,400 584	05 03	325 312
Chromium (ug/L)					
16087	DMQ ANL	01 01	730 415	05 03	312 82
Zinc (ug/L)					
16041	DMQ ANL	02 01, 03, 05, 06	505 310	04 02	214 85
16087	DMQ	01	550	05	380

ANL: Analytical data
DET: Detailed Questionnaire data
DMQ: Detailed Monitoring Questionnaire data

Table 11-18: BPT Facility Data Excluded from the Calculation of Hazardous BPT/BAT Limitations

BPT Facility	Influent Sample Point	Avg. Influent Conc.	Effluent Sample Point	Avg. Effluent Conc.	Reason for Exclusion
BOD_5 (Transferred from the Non-Hazardous subcategory) (mg/L)					
16041 DMQ	02 02	- -	04 04	- -	No data No data
16058	-	-	01	22	Detailed questionnaire data was not used
16087 ANL	01 01	2,980 3,721	03 03	258 66	Effluent concentration above 50 mg/L Effluent concentration above 50 mg/L
16118	01	2,200	02	49	Detailed questionnaire data was not used
16120 ANL	- 01	- 1,290	02 -	15.9 -	Detailed questionnaire data was not used No effluent data.
16122 DMQ	01 01	- -	03 03	5.3 5.4	Effluent sample point 03 located after aerated equalization
16132	01,02,03	5,581	04	7	Detailed questionnaire data was not used
16253	01	1,000	02	5.2	Detailed questionnaire data was not used
TSS (Transferred from the Non-Hazardous subcategory) (mg/L)					
16041 DMQ ANL	02 02 1, 3, 5, 6	364 307 70	04 04 02	36 35 46	Facility wastewater treatment system does not employ filtration
16058 DMQ ANL	- - 01, 02	- - 14,470	01 01 -	216 188 -	Facility wastewater treatment system does not employ filtration
16087 DMQ ANL	01 01 01	586 579 172	03 05 03	51 114 78	Facility wastewater treatment system does not employ filtration
16118 DMQ	01 01	- -	02 02	- -	Facility wastewater treatment system does not employ filtration
16120 ANL	- 01	- 200	02 -	14 -	Detailed questionnaire data was not used No effluent data
16122 DMQ ANL	01 01 01,02,03	- - 267	03 03 07	5.6 5.4 12.5	Facility eliminated due to settling that can occur in equalization tanks prior to filtration
16132 DMQ	01,02,03 01,02,03	244 -	04 04	39 47	Facility wastewater treatment system does not employ filtration
16253	01	180	02	17.5	Detailed questionnaire data was not used

Table 11-18: BPT Facility Data Excluded from the Calculation of Hazardous BPT/BAT Limitations (continued)

BPT Facility	Influent Sample Point	Avg. Influent Conc.	Effluent Sample Point	Avg. Effluent Conc.	Reason for Exclusion
Ammonia (Transferred from the Non-Hazardous subcategory) (mg/L)					
16041	02	554	04	5.0	Detailed questionnaire data was not used
16058	-	-	01	-	No data
DMQ	-	-	01	-	No data
ANL	01, 02	2,900	-	-	No effluent data
16087	01	-	03	-	No data
DMQ	01	-	05	-	No data
ANL	01	209	03	153	Minimal ammonia removal
16118	01	-	02	-	No data
DMQ	01	-	02	-	No data
16120	-	-	02	1.35	Facility wastewater treatment system employed an air stripper
DMQ	01	362	02	5.98	
ANL	01	245	-	-	
16122	01	136	03	0.87	Effluent sample point 03 located after aerated equalization
DMQ	01	135	03	0.48	
16132	01,02,03	-	04	-	No data
16253	01	-	02	-	No data
DMQ	01	-	02	0.01	No influent data
Alpha Terpineol (ug/L)					
16041	02	-	04	-	No data
DMQ	02	-	04	-	No data
16087	01	-	03	-	No data
DMQ	01	-	05	-	No data
ANL	01	10	03	10	Influent concentration < 10xMDL
Aniline (ug/L)					
16041	02	-	04	-	No data
DMQ	02	-	04	-	No data
16087	01	-	03	-	No data
DMQ	01	-	05	-	No data
Benzoic Acid (ug/L)					
16041	02	-	04	-	No data
DMQ	02	-	04	-	No data
16087	01	-	03	-	No data
DMQ	01	-	05	-	No data

Table 11-18: BPT Facility Data Excluded from the Calculation of Hazardous BPT/BAT Limitations (continued)

BPT Facility	Influent Sample Point	Avg. Influent Conc.	Effluent Sample Point	Avg. Effluent Conc.	Reason for Exclusion
Naphthalene (ug/L)					
16041	02	-	04	-	No data
DMQ	02	-	04	-	No data
16087	01	-	03	-	No data
DMQ	01	-	05	-	No data
ANL	01	25	03	10	Influent concentration < 10xMDL
P-Cresol (ug/L)					
16041	02	-	04	-	No data
DMQ	02	-	04	-	No data
16087	01	-	03	-	No data
DMQ	01	-	05	-	No data
Phenol (ug/L)					
16041	02	-	04	-	No data
DMQ	02	-	04	-	No data
16087	01	98,500	03	814	Detailed questionnaire data was not used
DMQ		-	05	-	No data
Pyridine (ug/L)					
16041	02	-	04	-	No data
DMQ	02	-	04	-	No data
ANL	1, 3, 5, 6	23	02	10	Influent concentration < 10xMDL
16087	01	-	03	-	No data
DMQ	01	-	05	-	No data

Table 11-18: BPT Facility Data Excluded from the Calculation of Hazardous BPT/BAT Limitations (continued)

BPT Facility	Influent Sample Point	Avg. Influent Conc.	Effluent Sample Point	Avg. Effluent Conc.	Reason for Exclusion
Arsenic (ug/L)					
16041	02	-	04	-	No data
DMQ	02	-	04	-	No data
ANL	1, 3, 5, 6	535	02	569	Negative percent removal
16087	01	1,420	03	193	Detailed questionnaire data was not used
Chromium (ug/L)					
16041	02	210	04	120	Detailed Questionnaire data was not used
DMQ	02	419	04	417	No removal
ANL	1, 3, 5, 6	82	02	46	Influent concentration < 10xMDL
16087	01	731	03	501	Detailed questionnaire data was not used
Zinc (ug/L)					
16041	02	1,130	04	200	Detailed questionnaire data was not used
16087	01	560	03	279	Detailed questionnaire data was not used
ANL	01	126	03	52	Influent concentration < 10xMDL

ANL: Analytical data
DET: Detailed Questionnaire data
DMQ: Detailed Monitoring Questionnaire data

Table 11-19**:** BPT/BAT Limitations for the Hazardous Subcategory

Pollutant or Pollutant Property	Maximum for 1 day (mg/L)	Monthly Average Shall Not Exceed (mg/L)
BOD_5	220	56
TSS	88	27
Ammonia	10	4.9
Alpha Terpineol	0.042	0.019
Aniline	0.024	0.015
Benzoic Acid	0.119	0.073
Naphthalene	0.059	0.022
P-Cresol	0.024	0.015
Phenol	0.048	0.029
Pyridine	0.072	0.025
Arsenic	1.1	0.54
Chromium	1.1	0.46
Zinc	0.535	0.296
pH	([1])	([1])

([1]) pH shall be in the range 6.0 - 9.0 pH units.

Table 11-20: Comparison of Long-Term Averages for Nonconventional and Toxic Pollutants Regulated Under BAT for the Non-Hazardous Subcategory

Pollutant	BPT Option II: Equalization + Biological + Multimedia Filter (mg/L)	Reverse Osmosis single stage effluent (mg/L)	Reverse Osmosis second stage effluent (mg/L)
Ammonia	5.4	13	0.59
Alpha Terpineol	0.010 ND	0.010 ND	0.010 ND
Benzoic Acid	0.050 ND	0.093	0.050 ND
P-Cresol	0.010 ND	0.253	0.022
Phenol	0.010 ND	0.185	0.029

ND: Non-detect

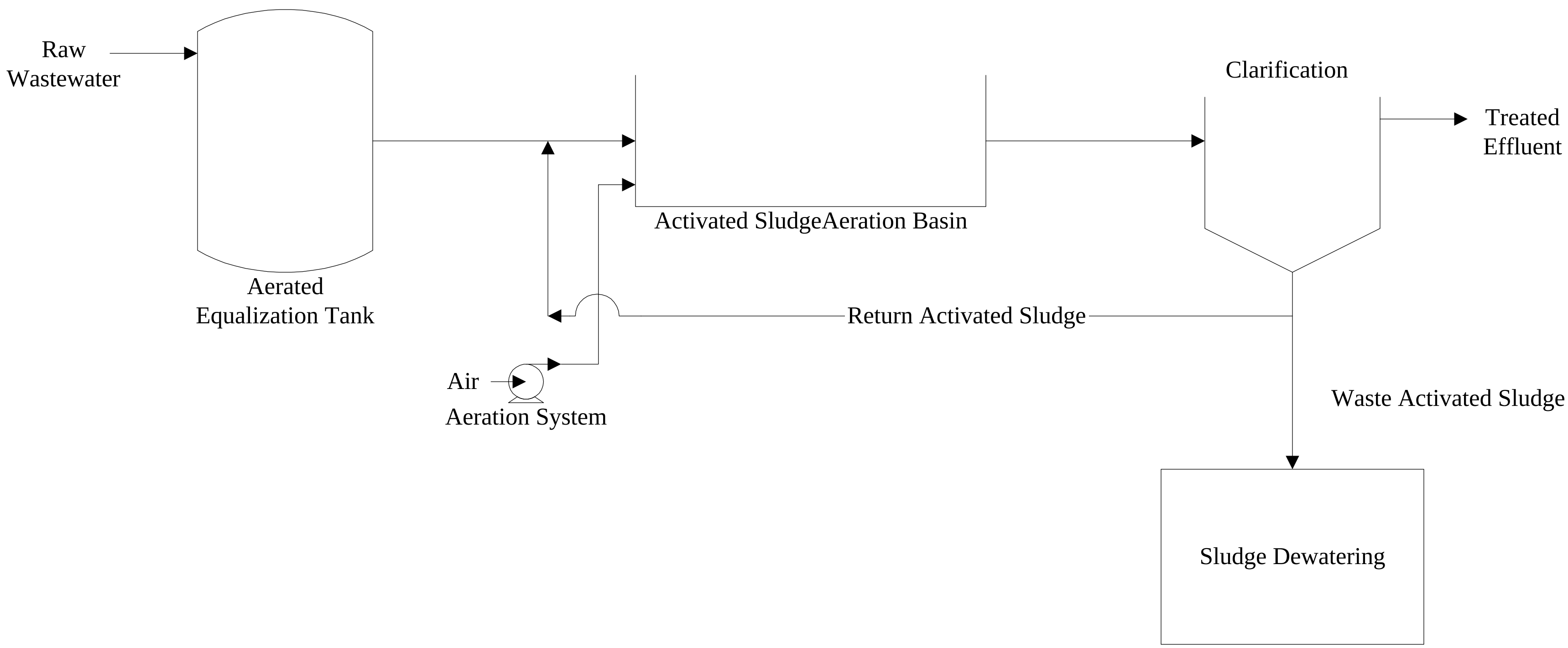

Figure 11-1: BPT/BCT/BAT/PSES/PSNS Non-Hazardous Subcategory Option I Flow Diagram

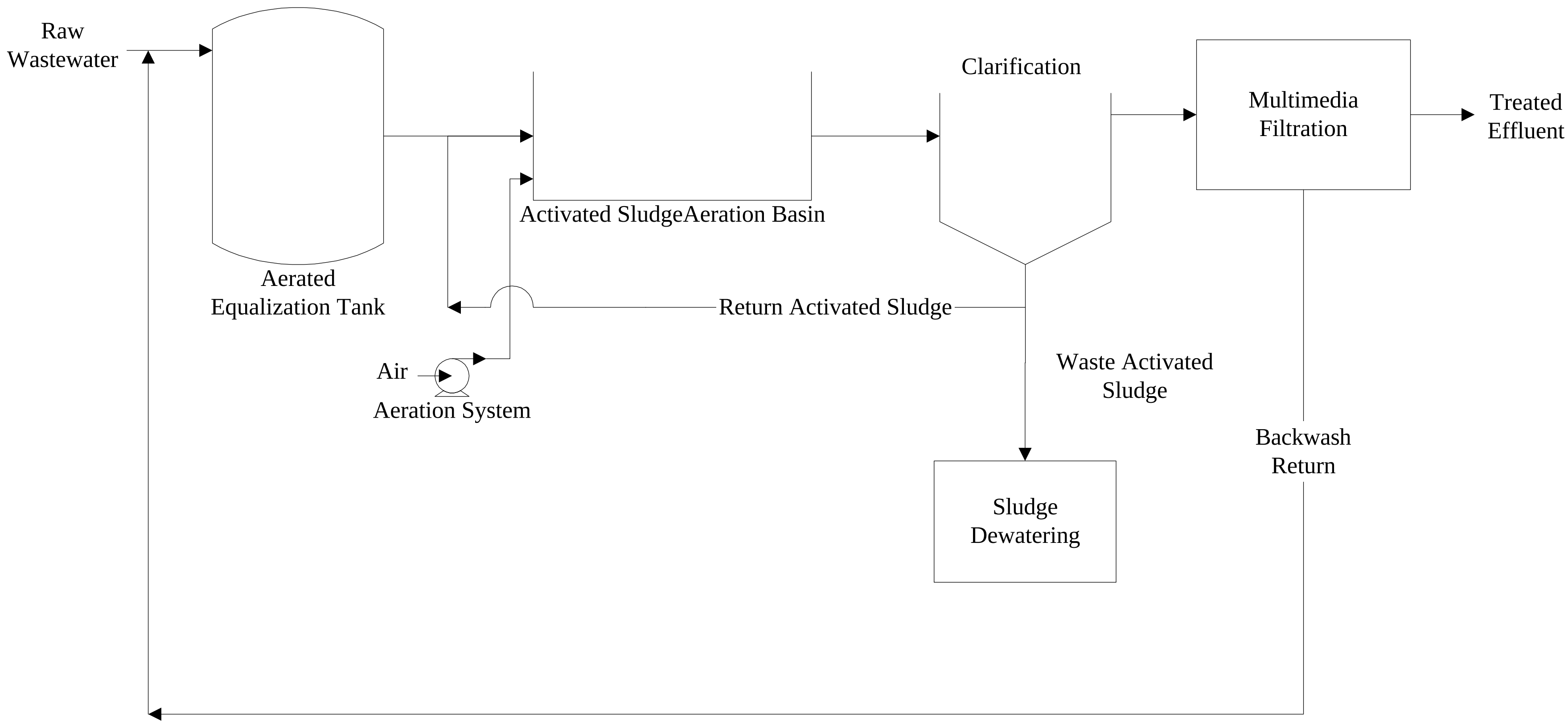

Figure 11-2: BPT/BCT/BAT Non-Hazardous Subcategory Option II & NSPS Flow Diagram

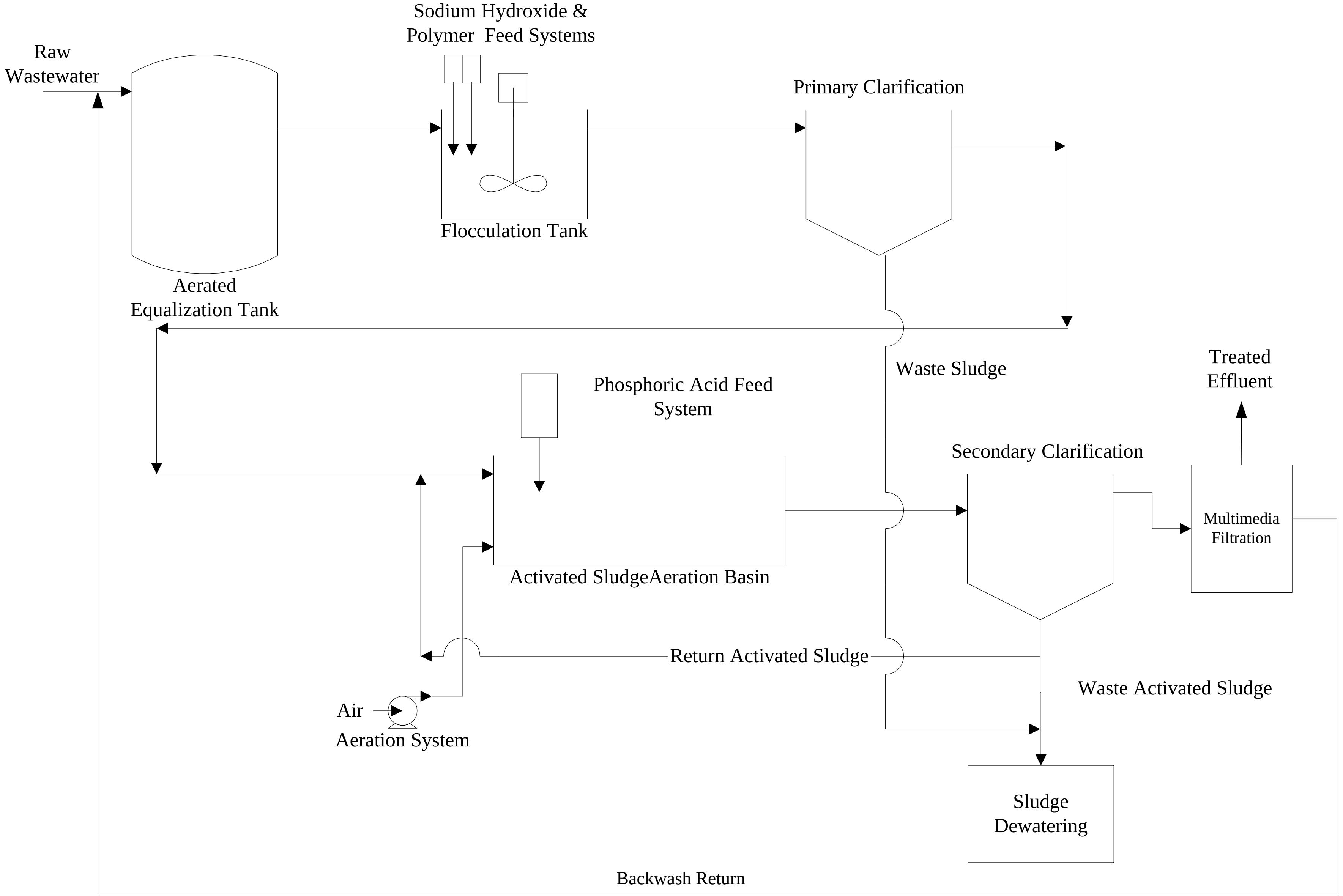

Figure 11-3: BPT/BCT/BAT Hazardous Subcategory Option II & NSPS Flow Diagram

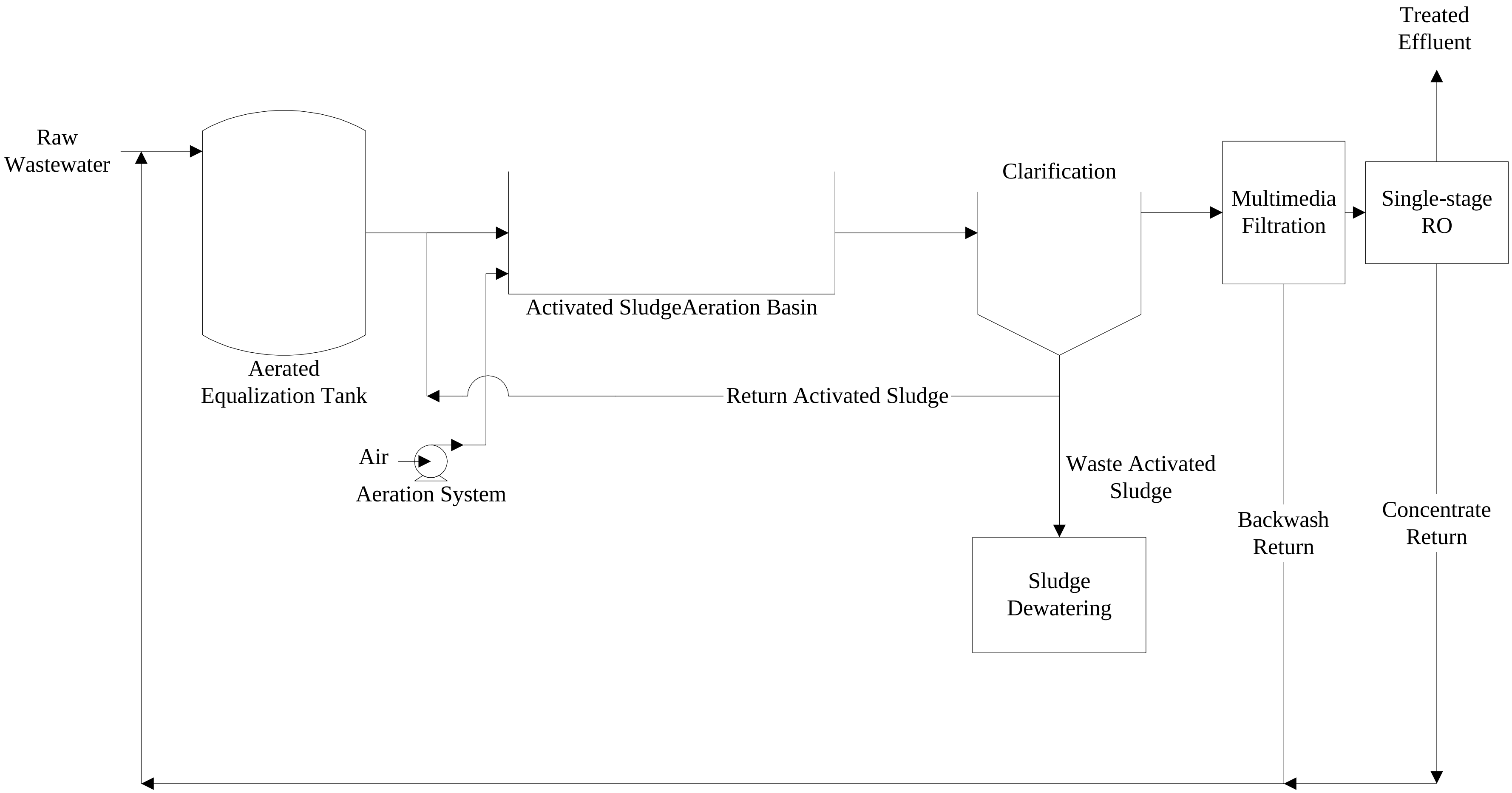

Figure 11-4: BAT Non-Hazardous Subcategory Option III Flow Diagram

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APPENDIX A:

SECTION 308 SURVEY FOR LANDFILLS - INDUSTRY POPULATION ANALYSIS

Appendix A: Section 308 Survey for Landfills-Industry Population Analysis

The list of landfills needed to define the landfill population in the United States was developed from various sources: state environmental and solid waste departments, and other state contacts; the National Survey of Hazardous Waste Treatment Storage, Disposal, and Recycling Facilities respondent list; Environmental Ltd.'s 1991 Directory of Industrial and Hazardous Waste Management Firms; the Resource Conservation and Recovery Act (RCRA) 1992 list of Municipal Solid Waste Landfills; and the Resource Conservation and Recovery Information System (RCRIS) National Oversight Database.

The information provided by state environmental departments was requested during early stages of the rulemaking process for Centralized Waste Treatment and represented 1987-88 data for both active and inactive landfills. This information was incomplete to some extent. For 18 of the 50 states only limited or no information was available. Hence, these states were contacted during the data gathering effort for the development of effluent guidelines and standards for Landfills and Incinerators to obtain updated lists of landfills and wastewater collection information.

The duplication of landfill entries among various sources was eliminated as far as possible by cross checking using computer programs. However, some duplication in Subtitle D landfills is inevitable as some of the various identifiers were unclear.

Landfill population was divided into two categories: Subtitle C (hazardous waste) and Subtitle D (non-hazardous waste). In total, mailing addresses were compiled for 595 Subtitle C landfills and 9,882 Subtitle D landfills. In addition, 448 Subtitle D landfills were identified for which addresses were inadequate for delivery. Thus the population of Subtitle D amounted to 10,330. Table 1 provides a list of the number of landfills with deliverable mailing addresses in each state by category.

Selection of the landfills to survey

From the identified landfill population of 10,925 Subtitle C and D facilities, screener surveys were mailed to 4996. Facilities receiving the screener survey included all of the 595 Subtitle C landfills and a sample of the 9,882 Subtitle D facilities with mailable addresses.

TABLE 1. COUNT OF LANDFILLS WITH MAILABLE ENTRIES IN EACH STATE

State	Subtitle-D	Subtitle-C	Total
Alabama	238	38	276
Alaska	201	1	202
Arizona	90	2	92
Arkansas	134	3	137
California	630	16	646
Colorado	216	12	228
Connecti-cut	125	22	147
Delaware	8	14	22
Florida	91	9	100
Georgia	277	17	294
Hawaii	15	1	16
Idaho	112	6	118
Illinois	182	14	196
Indiana	101	29	130
Iowa	118	13	131
Kansas	118	8	126
Kentucky	121	33	154
Louisiana	73	17	90

State	Subtitle-D	Subtitle-C	Total
Maine	291	2	293
Maryland	50	5	55
Massachu-setts	722	1	723
Michigan	762	9	771
Minnesota	257	4	261
Mississippi	97	3	100
Missouri	128	7	135
Montana	257	1	258
Nebraska	41	8	49
Nevada	127	3	130
New Hapmshire	58	0	58
New Jersey	467	8	475
New Mexico	121	7	128
New York	565	10	575
North Carolina	244	39	283
North Dakota	85	1	86
Ohio	119	24	143
Oklahoma	189	7	196
Oregon	231	10	241
Pennsyl-vania	41	22	63
Rhode Island	12	0	12
South Carolina	127	9	136

State	Subtitle-D	Subtitle-C	Total
South Dakota	193	0	193
Tennessee	112	9	121
Texas	601	70	671
Utah	92	7	99
Vermont	73	0	73
Virginia	440	8	448
Washington	72	9	81
West Virginia	57	5	62
Wisconsin	183	3	186
Wyoming	218	45	263
Puerto Rico	0	3	3
Guam	0	1	1
Total	9882	595	10477

The remaining 4401 screener surveys were sent to Subtitle D landfills. A statistical approach was taken to sample the 9882 deliverable Subtitle D facilities. For sampling purposes, the 9882 Subtitle D landfills were stratified into three categories:

1) landfills with known wastewater collection
2) landfills from states with fewer than 100 landfills and
3) landfills from states with more than 100 landfills.

All landfills with known wastewater collection were included in the landfill survey sample. The population included 134 landfills with known wastewater collection (1.35%).

Landfills in states with fewer than 100 landfills were stratified from the landfills in states with more than 100 landfills. This was simply a sampling technique for random sampling and was done to ensure the inclusion of a representative number of facilities from each stratum.

There were 16 states with under 100 landfills each (after exclusion of known wastewater collectors), which accounted for 892 landfills. A screener survey was mailed to each of these 892 landfills. The remaining 24 states, with over 100 landfills each, accounted for 8856 landfills. A random sample of 3375 was taken from this strata, and a screener survey was mailed to each of these randomly selected landfills. Table 2 summarizes the stratification.

Screener surveys were distributed by both Federal Express and U.S. certified mail: 1916 surveys were sent via Federal Express, which resulted in 94% receipt confirmation; 3080 surveys were sent via U.S. certified mail, which resulted in 92% receipt confirmation. Twenty three additional screener surveys were mailed because of change of ownership, or different mailing address, even though the physical location of the landfill remained same. A summary of analysis on these additional surveys is presented in Table 3. Thus, a total of 5020 landfill screener surveys were distributed.

TABLE 2. SUMMARY OF STRATIFICATION

Strata #	Population	# in frame	# in sample
1	Subtitle C	595	595
2	Subtitle D -known wastewater generators	134	134
3	Subtitle D - states with ≤ 100 landfills	892	892
4	Subtitle D - states with >100 landfills	8856	3375
	Total	10477	4996

A completed screener survey was received from 3628 landfills excluding the late arrivals. This includes response from a pre-test screener survey. The status of remaining screener surveys is:

- 353 surveys were deemed non-deliverables due to incorrect/non-traceable addresses and were returned to the sender
- 1008 landfills were presumed to be non-respondents
- 4 landfills were found to be out-of-business
- 26 landfills were declared ineligible to participate in the survey for reasons discovered during the mid-point remainder calls
- 1 respondent refused to respond to the survey.

For statistical analysis purposes, screener surveys in each of the above categories were traced back to the respective strata. Table 4 presents a breakdown of these remaining screener surveys by strata.

TABLE 3. SUMMARY OF ADDITIONAL SCREENER SURVEY ANALYSIS

Screener ID	Original ID	Stratum	Reason for re-assignment
15100	13235	4	screener sent to former owner or incorrect address
15101	14044	4	screener sent to former owner or incorrect address
15102	13876	4	screener sent to former owner or incorrect address
15103	11594	4	screener sent to former owner or incorrect address
15104	14117	4	screener sent to former owner or incorrect address
15105	13953	4	screener sent to former owner or incorrect address
15106	13264	4	screener sent to former owner or incorrect address
15107	10985	4	additional screener resp. was obtained for a new landfill
15108	14449	4	additional screener resp. was obtained for a new landfill
15109	12167	1	additional screener resp. was obtained for a new landfill
15110	12883	4	additional screener resp. was obtained for a new landfill
15111			response transferred from pre-test screener survey
15112	14112	4	screener sent to former owner or incorrect address
15113	11319	3	screener sent to former owner or incorrect address
15114	12327	4	screener sent to former owner or incorrect address
15116	11528	4	screener sent to former owner or incorrect address
15117	13389	3	screener sent to former owner or incorrect address
15118	13995	4	screener sent to former owner or incorrect address
15119	14779	4	screener sent to former owner or incorrect address
15120	11422	4	screener sent to former owner or incorrect address
15121	13976	4	screener sent to former owner or incorrect address
15122	12422	1	screener sent to former owner or incorrect address
15123	11299	4	screener sent to former owner or incorrect address
15124	10851	4	screener sent to former owner or incorrect address

Among the 3628 survey responses received, a total of 3581 surveys were sent to data entry; 44 were declared ineligible upon reviewing their response, and were not processed any further; 3 remained incomplete because of unsuccessful attempts to contact the respondents to complete the review process. A total of 859 respondents were found collecting some type of wastewater (landfills collecting only storm water were not included) generated from their landfill operations, and were considered as in scope population from which a sample of facilities will be selected to receive the detailed Section 308 landfill questionnaire. The rest of the surveys sent to data entry were considered out of scope. For statistical analysis purposes, screener surveys not sent to data entry, the out of scope surveys, and the in scope surveys were traced back to the respective strata, and a count of these in each strata is presented in Table 4.

A response bias query was conducted on about 5.65% (57 landfills) of the 1008 presumed non-respondents. Each of these 57 randomly-selected landfills was called to discern the reasons that the screener survey was not received. The result of this effort is as follows:

- 25 facility contacts said that they over looked/misplaced/forgotten the survey (1 in stratum 2; 1 in stratum 3; and 23 in stratum 4)

- 19 facility contacts said that they did not recall receiving any survey (2 in stratum 1; 3 in stratum 3; and 14 in stratum 4)

- 7 facility contacts said that they did not feel it was applicable to them (1 in stratum 1; 2 in stratum 3; and 4 in stratum 4)

- 3 facility contacts said that they forgot and would complete the survey and return (2 in stratum 3; and 1 in stratum 4)

- 2 facility contacts said that they received duplicate surveys, and this was checked and found correct (these 2 are in stratum 4)

- 1 facility contact said that they are under bankruptcy proceedings (this is in stratum 1).

A total of 39 landfill screener survey responses were received past the deadline. since these were received after the close of the screener survey database, they were not considered for any further analyses. Among these 39 late arrivals, only four landfills collected wastewater generated from landfill operations (landfill leachate and contaminated groundwater), and none of these four landfills have any on-site treatment. Additional information on these four landfills is: two were municipal, non-commercial, and discharged untreated wastewater to a Publicly Owned Treatment Works (POTW); one was government, commercial, and discharged untreated wastewater to a POTW; one was private and sent their wastewaters for off-site disposal.

Questionnaire distribution

A total of 859 landfill operators reported that they collect one or more type of wastewater generated from the landfill operations (landfills collecting only storm water were not included). These landfills were considered as the sample frame to receive the Section 308 questionnaire for landfills. Facilities with treatment were targeted most heavily, while some facilities without treatment but collect wastewater were randomly selected to receive only Section A of the questionnaire. The facilities selected fall into any of the following eight categories:

1. Commercial private, municipal, or government facilities which have wastewater treatment and are direct or indirect dischargers. A census was conducted of this part of the industry.

2. Commercial private, municipal, or government facilities which have wastewater treatment and are zero dischargers (do not discharge to surface water or to a POTW). Approximately 25% of these were randomly chosen to receive the questionnaire.

3. Non-commercial private facilities with wastewater treatment. Approximately 40% of these were randomly chosen to receive the questionnaire.

4. Facilities with no wastewater treatment. Approximately 10% of these were randomly chosen to receive only Section A of the questionnaire.

5. Commercial facilities who accept PCB wastes. Only one facility was in this category, and was chosen.

6. Municipal hazardous waste landfills. There were two facilities in this category, and a census was conducted of this part of the industry.

7. Small business with no wastewater treatment. A census was conducted of this part of the industry.

8. Pre-test facility which was not in the screener population. Only one facility was in this category, and was chosen based on knowledge of the industry and professional judgement.

For statistical analysis purposes, the facilities in each of the aforementioned categories were traced back through their screener surveys to the respective strata, and a count of these in each strata is presented in Table 5.

Section 308 Questionnaires were sent to a total of 252 mailing addresses that were considered in scope from their screener responses. The questionnaire response was received from 248 landfills. The remaining four landfills were presumed to be non-respondents. The questionnaire responses received included four responses from pre-test questionnaires. Thus a total of 248 responses were available for further review.

Among the survey responses obtained, 22 were declared out of scope upon reviewing their response and were not processed any further; 226 were reviewed for completeness and technical accuracy and were entered into the landfill questionnaire database. For statistical analysis purposes, the 252 questionnaires that were sent, including the 226 questionnaires reviewed and placed in the database, were traced back to the original screener population strata, and a count of these in each strata is presented in Table 4.

TABLE 4. COUNT OF SCREENER SURVEYS IN EACH CATEGORY BY STRATA[1]

Category	Stratum 1	Stratum 2	Stratum 3	Stratum 4	Total
Non-respondents	69	15	170	755	1009
Ineligible[2]	79	9	45	294	427
Incomplete	2	0	1	0	3
In scope	141	91	222	405	859
Out of scope	305	20	456	1941	2722
Quest. recipients	51	35	77	88	252[3]
Quest. in database	46	32	71	76	226[3]
Quest. out of scope	4	3	4	11	22
Quest. non-response	1	0	2	1	4

[1]For each of the category presented below, a list of Survey ID numbers and their respective strata # is presented in Appendix A.

[2]This includes all non-deliverables, out-of-business, and duplicate addresses.

[3]An additional one is the pre-test questionnaire, which is not part of any stratum.

TABLE 5. QUESTIONNAIRE SELECTION BY CATEGORY

Category	Stratum 1	Stratum 2	Stratum 3	Stratum 4	Total
Pri/com/muni/govt./with treat/D-I discharge	12	27	51	38	128
Pri/non-com/with treatment	30	2	3	7	42
Pri/com/muni/govt./with treat/Zero discharge	1	0	7	0	8
No treatment	5	6	14	38	63
PCB facilities with treatment	0	0	1	0	1
Municipal/hazardous	2	0	0	0	2
Small business/no treatment	1	0	1	5	7
Pre-test not in Screener population[4]	-	-	-	-	1
Totals	51	35	77	88	252

[4]This is a pre-test questionnaire and is not in any stratum because, it was not in the screener database.

TABLE 6. IN SCOPE SCREENERS NOT SELECTED FOR QUESTIONNAIRE BY CATEGORY

Category	Stratum 1	Stratum 2	Stratum 3	Stratum 4	Total
Pri/com/muni/govt./with treat/D-I discharge	0	0	0	0	0
Pri/non-com/with treatment	31	0	6	27	64
Pri/com/muni/govt./with treat/Zero discharge	7	2	9	7	25
No treatment	52	54	130	283	519
PCB facilities with treatment	0	0	0	0	0
Municipal/hazardous	0	0	0	0	0
Small business/no treatment	0	0	0	0	0
Totals	90	56	145	317	608

APPENDIX B:

DEFINITIONS,
ACRONYMS, AND ABBREVIATIONS

APPENDIX B: DEFINITIONS, ACRONYMS, AND ABBREVIATIONS

ADMINISTRATOR: The Administrator of the U.S. Environmental Protection Agency.

AGENCY: The U.S. Environmental Protection Agency.

AVERAGE MASTER FILE: A method of calculating the average raw wastewater concentration for each pollutant of interest in a subcategory. The Average Master File was calculated using all available data collected in the Landfills industry study.

BASELINE FLOW: Estimated wastewater discharge flow rate for a selected facility in 1992 based on their Detailed Questionnaire response.

BAT: The best available technology economically achievable, applicable to effluent limitations to be achieved by July 1, 1984, for industrial discharges to surface waters, as defined by Sec. 304(b)(2)(B) of the CWA.

BCT: The best conventional pollutant control technology, applicable to discharges of conventional pollutants from existing industrial point sources, as defined by Sec. 304(b)(4) of the CWA.

BOD_5: Biochemical oxygen demand - Five Day. A measure of the biochemical decomposition of organic matter in a water sample. It is determined by measuring the dissolved oxygen consumed by microorganisms to oxidize the organic contaminants in a water sample under standard laboratory conditions of five days and 70 degrees Celsius. BOD_5 is not related to the oxygen requirements in chemical combustion.

BPT: The best practicable control technology currently available, applicable to effluent limitations to be achieved by July 1, 1977, for industrial discharges to surface waters, as defined by Sec. 304(b)(1) of the CWA.

CAPDET: Computer-Assisted Procedure for the Design and Evaluation of Wastewater Treatment Systems. Developed by the U.S. Army Corp. of Engineers, CAPDET is intended to provide planning level cost estimates to analyze alternate design technologies for wastewater treatment systems.

CAPTIVE: Used to describe a landfill that is directly associated with an industrial or commercial operation. See Chapter 2 for the conditions that a captive landfill must meet in order to be excluded from the landfill effluent guideline.

CELL: An area of a landfill that is separated from other areas by an impervious structure. Each cell has a separate leachate collection system or would require a separate leachate collection system if one were installed. Individual leachate collection systems that are combined at the surface are considered separate systems by this definition.

CLEAN WATER ACT (CWA): The Federal Water Pollution Control Act Amendments of 1972 (33 U.S.C. Section 1251 et seq.), as amended by the Clean Water Act of 1977 (Pub. L. 95-217), and the Water Quality Act of 1987 (Pub. L. 100-4).

CLEAN WATER ACT (CWA) SECTION 308 QUESTIONNAIRE:
A questionnaire sent to facilities under the authority of Section 308 of the CWA, which requests information to be used in the development of national effluent guidelines and standards.

CLOSED: A facility or portion thereof that is currently not receiving or accepting wastes and has undergone final closure.

COMMERCIAL FACILITY: A facility that treats, disposes, or recycles/recovers the wastes of other facilities not under the same ownership as this facility. Commercial operations are usually made available for a fee or other remuneration. Commercial waste treatment, disposal, or recycling/recovery does not have to be the primary activity at a facility for an operation or unit to be considered "commercial".

CONTAMINATED GROUND WATER: Water below the land surface in the zone of saturation which has been contaminated by landfill leachate. Contaminated ground water occurs at landfills without liners or at facilities that have released contaminants from a liner system. Ground water may also become contaminated if the water table rises to a point where it infiltrates the landfill or the leachate collection system.

CONTAMINATED STORM WATER: Storm water which comes in direct contact with landfill wastes, the waste handling and treatment areas, or wastewater that is subject to the limitations and standards. Some specific areas of a landfill that may produce contaminated storm water include (but are not limited to): the open face of an active landfill with exposed waste (no cover added); the areas around wastewater treatment operations; trucks, equipment or machinery that has been in direct contact with the waste; and waste dumping areas.

CONVENTIONAL POLLUTANTS: Constituents of wastewater as determined by Sec. 304(a)(4) of the CWA, including pollutants classified as biochemical oxygen demand, total suspended solids, oil and grease, fecal coliform, and pH.

DEEP WELL INJECTION: Disposal of wastewater into a deep well such that a porous, permeable formation of a larger area and thickness is available at sufficient depth to ensure continued, permanent storage.

DETAILED MONITORING QUESTIONNAIRE (DMQ): Questionnaires sent to collect monitoring data from 27 selected landfill facilities based on responses to the Section 308 Questionnaire.

DIRECT DISCHARGER: A facility that discharges or may discharge treated or untreated wastewater into waters of the United States.

DRAINED FREE LIQUIDS: Aqueous wastes drained from waste containers (e.g., drums, etc.) prior to landfilling. Landfills which accept containerized waste may generate this type of wastewater.

EFFLUENT LIMITATION: Any restriction, including schedules of compliance, established by a State or the Administrator on quantities, rates, and concentrations of chemical, physical, biological, and other constituents which are discharged from point sources into navigable waters, the waters of the contiguous zone, or the ocean. (CWA Sections 301(b) and 304(b)).

EPA: The U.S. Environmental Protection Agency.

EXISTING SOURCE: Any facility from which there is or may be a discharge of pollutants, the construction of which is commenced before the publication of the proposed regulations prescribing a standard of performance under Sec. 306 of the CWA.

FACILITY: All contiguous property owned, operated, leased or under the control of the same person or entity.

GAS CONDENSATE: A liquid which has condensed in the landfill gas collection system during the extraction of gas from within the landfill. Gases such as methane and carbon dioxide are generated due to microbial activity within the landfill, and must be removed to avoid hazardous conditions.

GROUND WATER: The body of water that is retained in the saturated zone which tends to move by hydraulic gradient to lower levels.

HAZARDOUS SUBCATEGORY: For the purposes of this guideline, Hazardous subcategory refers to all landfills regulated under Subtitle C of RCRA.

HAZARDOUS WASTE: Any waste, including wastewater, defined as hazardous under RCRA (40 CFR 261.3).

INACTIVE: A facility or portion thereof that is currently not treating, disposing, or recycling/recovering wastes.

INDIRECT DISCHARGER: A facility that discharges or may discharge wastewater into a publicly-owned treatment works (POTW).

INTRA-COMPANY: A facility that treats, disposes, or recycles/recovers wastes generated by off-site facilities under the same corporate ownership. The facility may also treat on-site generated wastes.

LANDFILL: An area of land or an excavation in which wastes are placed for permanent disposal, that is not a land application or land treatment unit, surface impoundment, underground injection well, waste pile, salt dome formation, a salt bed formation, an underground mine or a cave.

LANDFILL GENERATED WASTEWATER: Wastewater generated by landfill activities and collected for treatment, discharge or reuse, include: leachate, contaminated ground water, storm water runoff, landfill gas condensate, truck/equipment washwater, drained free liquids, floor washings, and wastewater from recovering pumping wells.

LEACHATE: Leachate is a liquid that has passed through or emerged from solid waste and contains soluble, suspended, or miscible materials removed from such waste. Leachate is typically collected from a liner system above which waste is placed for disposal. Leachate may also be collected through the use of slurry walls, trenches or other containment systems.

LEACHATE COLLECTION SYSTEM: The purpose of a leachate collection system is to collect leachate for treatment or alternative disposal and to reduce the depths of leachate buildup or level of saturation over the low permeability liner.

LINER: The liner is a low permeability material or combination of materials placed at the base of a landfill to reduce the discharge to the underlying or surrounding hydrogeologic environment. The liner is designed as a barrier to intercept leachate and to direct it to a leachate collection system.

LONG-TERM AVERAGE (LTA): For purposes of the effluent guidelines, average pollutant levels achieved over a period of time by a facility, subcategory, or technology option. LTAs are used in developing the limitations and standards in the landfill regulation.

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT: A permit to discharge wastewater into waters of the United States issued under the National Pollutant Discharge Elimination System, authorized by Section 402 of the CWA.

NEW SOURCE: As defined in 40 CFR 122.2, 122.29, and 403.3 (k), a new source is any building, structure, facility, or installation from which there is or may be a discharge of pollutants, the construction of which commenced (1) for purposes of compliance with New Source Performance Standards (NSPS) established under CWA section 306, after the promulgation of these standards; or (2) for the purposes of compliance with Pretreatment Standards for New Sources (PSNS), after the publication of proposed standards under CWA section 307 (c), if such standards are thereafter promulgated in accordance with that section.

NONCONVENTIONAL POLLUTANTS: Pollutants that are neither conventional pollutants listed at 40 CFR Part 401.16 nor priority pollutants listed in Appendix A of 40 CFR Part 423.

NON-CONTAMINATED STORM WATER: Storm water which does not come in direct contact with landfill wastes, the waste handling and treatment areas, or wastewater that is subject to the limitations and standards. Non-contaminated storm water includes storm water which flows off the cap, cover, intermediate cover, daily cover, and/or final cover of the landfill.

NON-HAZARDOUS SUBCATEGORY: For the purposes of this report, Non-Hazardous subcategory refers to all landfills regulated under Subtitle D of RCRA.

NON-WATER QUALITY ENVIRONMENTAL IMPACT: Deleterious aspects of control and treatment technologies applicable to point source category wastes, including, but not limited to air pollution, noise, radiation, sludge and solid waste generation, and energy usage.

NSPS: New Source Performance Standards, applicable to new sources of direct dischargers whose construction is begun after the publication of the proposed effluent regulations under CWA section 306.

OCPSF: Organic chemicals, plastics, and synthetic fibers manufacturing point source category. (40 CFR Part 414).

OFF-SITE: Outside the boundaries of a facility.

ON-SITE: The same or geographically contiguous property, which may be divided by a public or private right-of-way, provided the entrance and exit between the properties is at a crossroads intersection, and access is by crossing as opposed to going along the right-of-way. Non-contiguous properties owned by the same company or locality but connected by a right-of-way, which it controls, and to which the public does not have access, is also considered on-site property.

PASS THROUGH: A pollutant is determined to "pass through" POTWs when the nationwide median percentage removed by well-operated POTWs achieving secondary treatment is less than the percentage removed by the industry's direct dischargers that are using the BAT technology.

POINT SOURCE: Any discernable, confined, and discrete conveyance from which pollutants are or may be discharged.

POLLUTANTS OF INTEREST (POIs): Pollutants commonly found in landfill generated wastewater. For the purposes of this report, a pollutant of interest is a pollutant that is detected three or more times above a treatable level at a landfill, and must be present at more than one facility.

PRIORITY POLLUTANT: One hundred twenty-six compounds that are a subset of the 65 toxic pollutants and classes of pollutants outlined in Section 307 of the CWA. The priority pollutants are specified in the NRDC settlement agreement (Natural Resources Defense Council et al v. Train, 8 E.R.C. 2120 [D.D.C. 1976], modified 12 E.R.C. 1833 [D.D.C. 1979]).

PRODUCT STEWARDSHIP: These activities mean the acceptance for treatment and disposal of only the following materials: spent, or unused products; shipping and storage containers with product residue; off-specification products.

PSES: Pretreatment standards for existing sources of indirect discharges, under Sec. 307(b) of the CWA.

PSNS: Pretreatment standards for new sources of indirect discharges, applicable to new sources whose construction has begun after the publication of proposed standards under CWA section 307 (c), if such standards are thereafter promulgated in accordance with that section.

PUBLIC SERVICE: The provision of landfill waste disposal services to individual members of the general public, publicly-owned organizations (schools, universities, government agencies, municipalities) and not-for-profit organizations for which the landfill does not receive a fee or other remuneration.

PUBLICLY OWNED TREATMENT WORKS (POTW): Any device or system, owned by a state or municipality, used in the treatment (including recycling and reclamation) of municipal sewage or industrial wastes of a liquid nature that is owned by a state or municipality. This includes sewers, pipes, or other conveyances only if they convey wastewater to a POTW providing treatment (40 CFR 122.2).

RCRA: The Resource Conservation and Recovery Act of 1976 (RCRA) (42 U.S.C. Section 6901 et seq.), which regulates the generation, treatment, storage, disposal, or recycling of solid and hazardous wastes.

SUBTITLE C LANDFILL: A landfill permitted to accept hazardous wastes under Sections 3001 and 3019 of RCRA and the regulations promulgated pursuant to these sections, including 40 CFR Parts 260 through 272.

SUBTITLE D LANDFILL: A landfill permitted to accept only non-hazardous wastes under Sections 4001 through 4010 of RCRA and the regulations promulgated pursuant to these sections, including 40 CFR Parts 257 and 258.

SURFACE IMPOUNDMENT: A natural topographic depression, man-made excavation, or diked area formed primarily of earthen materials (although it may be lined with man-made materials), used to temporarily or permanently treat, store, or dispose of waste, usually in the liquid form. Surface impoundments do not include areas constructed to hold containers of wastes. Other common names for surface impoundments include ponds, pits, lagoons, finishing ponds, settling ponds, surge ponds, seepage ponds, and clarification ponds.

TOXIC POLLUTANTS: Pollutants declared “toxic” under Section 307(a)(1) of the Clean Water Act.

TRUCK/EQUIPMENT WASHWATER: Wastewater generated during either truck or equipment washes at the landfill. During routine maintenance or repair operations, trucks and/or equipment used within the landfill (e.g., loaders, compactors, or dump trucks) are washed and the resultant washwaters are collected for treatment.

VARIABILITY FACTOR: The daily variability factor is the ratio of the estimated 99th percentile of the distribution of daily values divided by the expected value, median or mean, of the distribution of the daily data. The monthly variability factor is the estimated 95th percentile of the distribution of the monthly averages of the data divided by the expected value of the monthly averages.

ZERO DISCHARGE: No discharge of pollutants to waters of the United States or to a POTW. Also included in this definition are alternative discharge or disposal of pollutants by way of evaporation, deep-well injection, off-site transfer, and land application.

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